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Christmas

THE Editorial Committee, the Editor and his staff wish to all readers of THE RECORD a very happy Christmas and a most prosperous New Year. In so doing they acknowledge most gratefully the work of all those members of the profession—authors, scrutineers and correspondents—who have combined to make possible the production of this, the only weekly veterinary journal in the world.

Christmas, both in its religious and its lay sense, is a feast, and it may be suggested that no body of persons does more, in the practical sphere, to help provide that plenty which is the very basis and essence of all feasting, than our own profession. The beginnings of the veterinary art are lost in antiquity; but may one not assume a bridge across the ages by which Xenophon's "doctors of oxen" were the very precursors of that anonymous veterinarian whose skilled husbandry helped produce the "gigantic round of cold beef" to which Mr. Pickwick addressed himself the night Jingle eloped with the spinster aunt?

The turkey, to whose rearing and prime condition our science is now addressing itself, is a comparatively recent addition to the Christmas table, but almost every other festive bird and beast down the ages has come within our orbit. The one occasion when the principal item of a feast lay outside the protection of the clinicians proved fatal! King John's surfeit of lampreys, surely, owed their toxicity—if that it was—to no other cause.

Not only feasting but certain gifts at Christmas time have their historic professional connection. From the splendid hounds given by the ancient Irish kings to their favourites, and the Arab horses exchanged between princes, right down to the puppies that will change hands between now and next Saturday, the veterinarian has played his part.

From the time of the first domestication of animals, with its incalculable benefits to the human race, those whose duty it has been, and is, to promote their productivity and health, and to save them from unnecessary pain have provided in every community an indispensable service. And since Christmas is not only a time of celebration and of goodwill but also one of the greatest among religious festivals, we may reflect, with humility, that the Founder of the Christian faith chose to be born among the beasts in a stable.

SIXTH CONGRESS PAPER

The Present Disease Position in the Poultry Industry

BY
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The discussion of the Congress paper took place during the morning of September 23rd. The Chairman was Mr. D. W. Menzies, and the recording secretary Mr. H. G. L. Harvey.

IN opening the session, the Chairman said that the subject for discussion was poultry. It was very gratifying to note that an increasing number of poultry specimens were submitted to Veterinary Investigation Centres by veterinary surgeons. He hoped that this service would be even more widely used in the future.

Dr. Gordon, introducing his paper, said: I would like in the first place to express my indebtedness to the organisers of the Congress for their invitation to present this paper, and for the opportunity which has been given to me to draw the profession's attention to the importance and, I suggest, the urgency of disease problems facing the expanding poultry industry.

I understand that the author is permitted only five minutes in which to introduce his paper. In view of the fact that these papers had to be submitted for publication early in July and that in the interval the 10th World's Poultry Congress was held in Edinburgh, I have requested and been granted a special dispensation of a further five minutes in which to refer to some of the more important issues arising from that Congress.

An attempt was made in my published paper to assess the mortality level and the economic loss from disease, based on records from egg laying tests. Laying trials, as pointed out, have certain limitations in assessing mortality, particularly the absence of the commoner infections, and the origin and selection of the populations recorded. It is interesting to find, therefore, that the suggested figure of a 20 per cent. mortality rate in this country is borne out by a survey, carried out by the Department of Economics of Bristol University, on ordinary commercial flocks located for the most part on general farms (Wragg 1954). In this survey of 37 flocks with an average size of 329 birds and involving a total of 12,175 fowls, the average mortality for the total sample was 14.6 per cent., ranging from a lower limit of 1.4 per cent. to an upper limit of 40.6 per cent. The flocks were sub-divided under the types of management concerned and, contrary to the assumption made in my published paper that a higher mortality might be anticipated under the highly intensive conditions of the deep litter system, this form of management showed the lowest average mortality —9.3 per cent. (range 1.4 to 15.4 per cent.). The second lowest average mortality occurred in battery cages—14.7 per cent. (range 2.8 to 40.6 per cent.), whilst the mortality rate, both in fold units and on the free range system, was slightly higher—at 18.4 and 18.6 per cent. respectively (ranging from 5.9 to 39.3 per cent.). It is pointed out, however, that too much importance should not be attached to these subgroups, as the samples are small and the dispersion considerable. The average size of the deep litter flocks and battery cages (246 birds) was very much smaller than the average size of the flocks under the extensive forms of management. This survey, which was extended to rearing flocks, indicates a very much higher mortality during the rearing period than that estimated from laying trial records. In 20 rearing flocks involving 7,252 birds reared to point-of-lay, the average mortality from day-old to six weeks of age was 5 per cent. (range 0.7 to 11.7 per cent.) and from six weeks to point-of-lay 14.5 per cent. (range 2.0 to 46.4 per cent.). The over-all mortality, therefore, from day-old to the end of the first laying season, based on this survey, is approximately 34 per cent. and considerably in excess of the figures suggested in the paper.

With regard to the World Poultry Congress, obviously one cannot refer to all of the 28 papers presented in the Disease Section, but to those who were unable to be present I would strongly recommend a perusal of the survey which Mr. J. E. Wilson gave to the plenary session on the work which has been carried out on poultry disease research during the last few years. For obvious reasons there is some overlapping in the conditions dealt with in my paper and those referred to in Mr. Wilson's survey, but a number of the points dealt with are worthy of further comment. Wilson also referred to fowl paralysis and its associated conditions, as the disease of the greatest economic importance. He pointed out that the position is now showing some clarification as the result of recent work and that there are sound grounds for considering the various forms of leucosis and the three types of fowl paralysis not of manifestations of a single disease but as separate entities with different causative agents.

Attention was also drawn to this fact in an excellent paper by Dr. J. G. Campbell in which he put forward a plea for a clarification of the avian leucosis complex. He considers that the cells involved in fowl paralysis accumulate in response to some irritant, almost certainly viral, and suggests that both fowl paralysis and osteo-petrosis should be removed

from the leucotic complex and set apart as distinct pathological entities while the complex should only include those conditions involving neoplasia of the haematopoietic cells. Based on the material discussed in this paper he presented a revised classification of the leucosis complex. Obviously this point, at first glance, of academic importance only, may, in view of other recent findings, prove to be of the highest importance in considering control measures for the various conditions hitherto included in the complex. Unfortunately, time prevented a full debate on this subject and I feel, in view of the evidence produced, that it would be of value if poultry pathologists and diagnosticians in this country could meet and consider not only an acceptable classification but evolve an agreed, simplified and authoritative explanation, understandable by the layman, of this complex, its component types, transmission and possible control.

At present a considerable amount of confusion, occasionally leading to litigation, results from inaccurate diagnosis and conflicting statements as to the mode of transmission of the disease. As I have pointed out in the paper there is now evidence that the agent responsible for the visceral type of fowl paralysis is present in the developing embryo and in the tissues of the newly hatched chick, but it was obvious from the views expressed at Edinburgh that the importance of egg transmission in the epidemiology of the disease is still open to speculation and doubt. There is as yet no evidence that the neural type of paralysis is egg transmitted. Recent work by Burmester and Gentry (1954) has shown that the causal agent of visceral fowl paralysis is present not only in oral secretions and in the faeces of naturally and artificially infected birds, but in the discharges of apparently healthy birds, and it would appear that clinically healthy birds in a flock may be carriers of the disease. The same authors suggest the presence in the faeces of normal birds of an agent which inactivates the virus.

Hutt (1954), in discussing the control of paralysis, still maintains that the only logical approach is the development of resistant lines and the isolation of chicken during the most susceptible period. Some doubt has been expressed, however, as to the practical and economic possibility of developing resistant strains and, as Wilson pointed out, this requires the exposure of young chicks to diseased birds, when with fully susceptible stock the results might well be disastrous, with the additional risk of introducing other infectious diseases. It was suggested that, contrary to the genetical approach, the final answer to the problem may be to attempt eradication of the virus from infected flocks and that the most important stage in such a policy would be the development of a suitable blood test for the identification of carriers while, in the meantime, research be directed towards a study of the causative agent or agents and the possible discovery of effective drugs or vaccines. It is obvious, however, that the establishment of the various forms of the disease complex as separate entities may well make it impossible to find drugs effective against all types and that the effective use of vaccines may be similarly limited. It was quite obvious from the papers and discussions at the Edinburgh Congress that although some progress is being made in our knowledge of the leucosis and paralysis complex, we are still unable to indicate clear cut or effective measures for its control.

Newcastle Disease Control

In referring to Newcastle disease control, Wilson drew attention to the use of mass or flock vaccination by the spray method; this was also reported by Crawley in the Disease Section, and by the use of a vaccine consisting of finely divided particles of infected chick embryo dispersed over the heads of the birds by simple dust pumps or aerosol disperser. Mass vaccination is also stated to have been effectively achieved by the addition of virus to the drinking water. These findings may be of great importance should future developments necessitate a change of policy in this country. Attention was also drawn to the increasing importance of chronic respiratory disease, particularly in broiler production, and the urgent need for a diagnostic method for the detection of carriers was stressed in view of the establishment of egg transmission of the disease.

Recent advances in avian therapy have been dealt with in my paper and at Edinburgh. The value of furazolidone in the treatment of fowl typhoid was confirmed by Harwood and Stunz (1954). Williams Smith (1954) has since reported on the value of this drug in the treatment of experimental *S. pullorum* infections in chicks. When the drug was administered in the mash continuously for 10 days at the higher level of 0.04 per cent. a recovery rate of 90 per cent. was achieved and none of the survivors were found to excrete the organism in their faeces. He also found that foci of *S. pullorum* infection in chicks which were chronic carriers were sterilised by furazolidone therapy.

Despite the valuable progress which has been made in avian therapy I would strongly support the recent warning given by Levine (1954) and repeated by Wilson, against the growing tendency to regard drugs and medicated feeding stuffs as a substitute for sound husbandry.

Finally, in my paper I have attempted to stress throughout the responsibility of the veterinary profession to the poultry industry based on the importance of that industry in our national economy and the magnitude of its disease problems. I have suggested that our apathy must be attributed largely to the failure of our Colleges in their approach to the subject. It was particularly interesting, therefore, to find an excellent paper presented to the 10th World's Poultry Congress by Dr. J. D. W. Coles of South Africa on the teaching of poultry science to veterinary students in that country. As Coles pointed out, it was recognised that it was ludicrous to attempt to teach veterinary students avian pathology while they remained woefully ignorant of poultry husbandry. A lectureship in poultry pathology has been established since 1931 together with a poultry plant now capable of housing over 4,000 fowls, turkeys and ducks. All aspects of poultry science except those

of a purely basic nature are dealt with within the one department for it is recognised to be a vast and intricate subject which can only be adequately dealt with by those well versed in the ramifications of the industry. The course extends over the fourth and fifth years of the curriculum and although formal lectures are give on systems of management, housing, incubation and brooding techniques, pedigree breeding, feeding and formulation of mashes, culling, grading and packing of produce, in addition to avian diseases, the main emphasis is on practical demonstrations and experience on the poultry plant, clinical observations and routine autopsies. The poultry diagnostic department or clinic provides sufficient material for each student to see about 1,000 cases during his two years and each student gets three spells for two weeks at a time on routine *post-mortem* duty. The examination at the end of the fifth year consists of a two hours' written paper, about one-third of which deals with husbandry, followed by a practical examination lasting an hour.

Surely, the poultry industry in this country with its present high status in our agricultural economy merits at least equal attention from our profession to that given to it in South Africa. I believe a course along the lines indicated by Coles to be the only logical and realistic approach to the problem of the indoctrination of veterinary graduates in this subject. I feel that as a Profession we are failing in our duty so long as we continue to ignore our obligations in this respect.

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THE PAPER

Dr. Gordon's paper, which had been circulated in advance, was as follows :—

IN a paper presented to the IXth World's Poultry Congress, Goldhaft (1951) in discussing the responsibility of the veterinary profession to the poultry industry stated that 85 per cent. of American farmers derive some income from poultry, and that in nine States poultry income ranks first, second in eight and third in four. He suggested that in a decade or two the income from poultry in America may rank first over all agricultural products, with comparable growth in Europe, Asia and Africa. That prophecy has to some extent been fulfilled in the U.K. for the income from poultry products is estimated to have reached £147 million and represents 12.04 per cent. of the total agricultural production (Ann. Rev. & Determination of Guarantees, 1954). If fatstock production is divided up into beef, mutton, pork and farm crops into wheat, oats, barley, etc., and each part given its own value, then egg and poultry production comes second to milk. The total poultry in the country at June 4th, 1953 was estimated to be 92,118,926 and the egg yield in 1951 8,449 million (A.R.C. 1953). It is necessary to appreciate these figures for, as Goldhaft points out, the phenomenal growth of the industry is all the more remarkable in the light of high morbidity and mortality. The Poultry Technical Committee in their report (1936) point out that the expansion of poultry farming in the U.K. was accompanied by a concomitant rise in mortality; and Dudley Dobson and Gordon (1941) showed that mortality in egg laying trials in England and Wales during the period 1929-37 rose with consistent regularity from 6·6 per cent. in 1926 to 17·7 per cent. in 1936-37. It may be of some significance that during the same period the poultry population in Great Britain increased from 42 million to approximately 60 million. It is of interest to note (Gordon, 1953a) that druing the war years the mortality level at the only laying trial existing at that time fell to approximately 10 per cent. while over the same period the poultry population was halved, decreasing from 52.5 million to 26 million. Since 1948 the industry has shown a steady expansion to reach the figure of 90 million already stated. What then has been the effect of this second expansion on mortality?

The yearly cost of livestock diseases in Great Britain was estimated a few years ago to be about £80 million or 15 per cent. of the annual value of livestock output at that date (Stableforth, 1954). If we accept the same figure of 15 per cent. as the loss to the poultry industry, then based on the industry's present value the annual loss from disease would be well in excess of £20 million.

Assessment of Poultry Mortality

The egg laying trials provide an accurate basis for assessing poultry mortality since the exact number of birds entering the trials are known and all deaths and culls are submitted for autopsy. They have the advantage that they represent a fair cross-section of the leading poultry breeders' stock with, therefore, a reasonable equation of genetical variability to disease. They have the disadvantage, however, that each owner's birds are selected with care and at the trial are maintained under conditions of relative isolation so that the common infections, apart from the leukosis complex, play little or no part in the mortality figures. The Poultry Research Station of the Animal Health Trust has been responsible, since 1949, for the *post-mortem* examination service to the National Egg Laying Test and the Poultry Production and Progeny Trials, the two largest trials in this country. These two trials have an important difference in their organisation. At the National Test each owner submits a pen of 6 pullets of approximately 5-6 months of age. The birds are penned separately in their owner groups and recorded for production over the succeeding 48 weeks. During the last four years the mortality in a total of approximately 3,270 birds housed annually has been 9.4, 9.1, 9.84 and 9.85. These figures take

no account, therefore, of losses experienced during rearing and are probably weighted, as already stated, by origin and selection.

The records from the P. & P.P. trials are more realistic for at this trial, at least in the progeny section, records are available from day old to the end of the first laying season and these progeny groups are formed by random selection. This trial consists of two sections; the parent section and the progeny trials. The parent section is similar to the National Laying test, each of 100 breeders submitting 12 pullets which are then recorded for the following 48 weeks. During the last four years the percentage mortality in the parent sections has been 10.92, 14.58, 10.1 and 12.9 respectively.

Each owner also submits a male bird and for a period of four consecutive weeks a total of 100 eggs is taken at random from each pen and incubated in four equal hatches. The resultant pullet chicks are reared in groups of equal numbers, made up as far as possible in equal proportions from the various pens so that all competitors' chicks experience similar conditions. On reaching an average age of 12 weeks all pullets in excess of 28 from any breeding pen are disposed of by random selection. When these pullets near the point of lay 20 are randomly sorted into owners' groups and placed in separate pens in intensive houses on the built-up-litter system. They are then subjected to a production test for a further period of 48 weeks. The conditions more nearly simulate those on commercial farms in that the chicks during the rearing are exposed to a cross section of other breeders' stock. In this section of the test the percentage mortality rate during the rearing period, *i.e.*, from day old to point of production, has been 4.5, 2.06 and 6.4 during the last three years. During the subsequent production period, the percentage mortality over the same years has been 20.1, 16.8 and 17.5.

It will be seen, therefore, that the percentage mortality from day old to the end of the first laying season has ranged from 18.8 to 24.6. This figure then must bear some relationship to the loss experienced by commercial egg producers who purchase their annual replacement stock either as day-old chicks or point of lay pullets. The rearing mortality similarly may bear some resemblance to the losses experienced in table poultry production. It has been pointed out, however (Gordon, 1953b), that throughout the industry as a whole, including commercial stocks from breeders, hatcheries, specialist egg and table poultry producers, general farms, small holdings and the like, the mortality must be greatly in excess of these figures when one considers the heavy losses impossible to assess, which result from infections such as pullorum disease, salmonellosis, fowl typhoid, coccidiosis and other parasites, respiratory infections, deficiency disorders and other conditions none of which contributed to the mortality on which these records are based.

The present adult poultry population in England and Wales is stated to be 60 million. It will be seen that, based on laying trials mortality, approximately $\frac{1}{5}$th of the birds die between the point of production and the end of their first laying year, that is about 12 million fowls annually. This is obviously a most conservative estimate in view of the absence of infectious diseases in this estimate but at the very least can be added the established figure of the one-half million fowls slaughtered during 1953 alone under the Fowl Pest Order. Temperton (1952) states that in the cost of rearing pullet replacements an equitable figure for a 5-months-old light-heavy cross bred is 25s. With an adult mortality in the region of at least 12½ million birds the monetary loss to the industry cannot be less than between £15 to £16 million. Admittedly some of this may be salvaged by the skilful culling of ailing birds, but this must be more than offset by the losses arising from epidemic disease. Furthermore, there is the non-assessable loss from sub-clinical disease interfering with optimal growth and production. As Stableforth (1954) points out "in assessing loss we have to remember also that many of our ideas of the normal healthy animal and its output are based on animals which were carrying some animal or vegetable parasite which is, or was, so common that it has been regarded as normal, or which in a variety of other ways are not as fully healthy as they can be."

Striking as these national figures may be they are somewhat unrealistic to the individual. Temperton (1952) however, showed that the two items of food cost and livestock depreciation together represent between 82 and 91 per cent. of the total cost of egg production with food remaining the most important single item varying from 44 to 58 per cent. of the total costs. He pointed out that, "despite the anxiety expressed at rising wages, the labour cost was only 5 to 10 per cent. of the total and that unless we know the proportions which the individual components of the cost structure bear to the whole, we may be in danger of straining at a gnat by attempting increased efficiency in relatively unimportant directions." It will be obvious that a reduction in mortality could play a far more important part in the reduction of production costs, and therefore in the cost of the end product to the consumer, than labour saving devices, many leading to less efficient stockmanship, overcrowding, lowering of sanitary standards and eventually increased mortality.

In a later paper on the economics of table chicken production, Temperton (1953) shows in tabular form the increase in cost per lb. live weight due to chick losses. For example, when the cost of production is 2s. per lb. live weight with no mortality, a 10 per cent. death rate increases the cost by 1.3 pence, and a 20 per cent. death by 3.0 pence. This figure increases considerably as the cost of production rises. Temperton suggests that although a 10 per cent. mortality does not increase the cost of production very seriously, the higher level to be expected with epidemic disease could exert a more serious effect in reducing profitability than a £10 per ton increase in feed costs. Golden (1953) suggests that a 3 per cent. mortality plus 4 per cent. culls during the 7-12 week period of table bird production has approximately the same effect as a £5 per ton increase in cost of feed.

Here surely is a real challenge to the veterinary profession for a reduction in mortality levels by even 5 per cent. could have a far more striking effect

on the efficiency of production; and on the cost to the consumer than even the outstanding nutritional and genetical advances of recent years.

The Causes of Mortality

So much for the economic effect of mortality; what of the causes? Reference to mortality records of the laying trials show that the avian leukosis complex is by far the largest single cause of death in adult poultry. Gordon (1953a) showed that this disease accounted for 25-30 per cent. of mortality during the first laying year, and during the progeny production period of the 1951-53 Poultry Production & Progeny Trials, avian leukosis accounted for 41 per cent. of the total losses. The final figures for the current 1952-54 trials were not available at the time of preparation of this paper but up to the end of the 9th month of the test 163 birds from a total of 286 deaths in the 1,900 which started the test died from this disease, a relative mortality from leukosis of 53 per cent. Other workers have drawn attention to the paramount importance of the leukosis complex in avian mortality, and Coles (1954) states that an analysis of the *post-mortem* examination records of the Veterinary Laboratory of the Ministry of Agriculture showed that during 1952 the number of carcases in which death or the ailing condition prior to slaughter was attributed to leukosis amounted to 23.2 per cent. of approximately 10,000 adult birds. If we accept the arguments advanced that adult mortality amounts to £15 million annually, then the leukosis complex must cost this industry nearly £4 million each year; far greater than the total compensation paid for birds slaughtered under the Fowl Pest Order during the entire seven years of the epizootic from 1947 to 1953 and which officially has amounted to £1,634,494. The economic importance of this disease, however, arises from the fact that in the majority of instances death occurs at the time when the fowl nears or reaches maturity. The poultry farmer has incurred the cost of purchasing or breeding the chick and of feeding and rearing it to the time when egg production should start and these costs are not offset by any income from egg production or, in most cases, as poultry flesh.

There appears to be little doubt that the disease is increasing in incidence, for reference to the mortality records of the Poultry Production and Progeny Trial shows that this disease has accounted for 34, 27.6, 41 and 53 per cent. of the mortality during the last four successive trials. Gordon (1953b) drew attention to apparent correlation between leukosis mortality and poultry population and showed that the incidence of the disease rose consistently from 16.6 of total mortality in 1930 to 33 per cent. in 1937, while during the same period the poultry population increased from 42 million to 61 million. During the war years the relative incidence of leukosis fell consistently to 13 per cent. in 1943 and during the same period the population was halved, decreasing to 26 million. The re-expansion of the industry since 1948 to reach the present figure of 90 million may, it is suggested, bear some significant correlation with the alarming increase in leukosis incidence to nearly 50 per cent. of adult mortality. It is of interest in this respect to note a similar hypothesis advanced by Cottral (1952). This author points out that when a population of chickens is followed up to 600 days of age 1 in every 5 are found to be affected with leukosis. This ratio is very much higher than that recorded for the lymphoblastoma group of diseases for any other species of animal and which ranges from 1 in 350,000 in sheep to approximately 1 in 10,000 in cattle and in man. He suggests that the high incidence is related to both the nature of the disease and the manner in which chicks are raised. No other domesticated or wild animals are so artificially mass produced or raised in such crowded quarters nor are other animals exposed at 1 day of age to large populations of their kind from a variety of sources. He also points out that the epidemiological history of leukosis shows that in all countries the incidence of the disease is related to the expansion and modernising of the poultry industry and the adoption of mass production methods.

Breeding for Resistance

Unfortunately, we seem no nearer a real solution to the control of this disease and most workers have agreed that the only practical approach has been to attempt to breed and subsequently distribute stock genetically resistant to the disease allied to brooding and rearing the chicks as remotely from adult stock as is practical (Hutt & Cole, 1953). Coles (1954), however, reporting the results of a 5-year attempt to develop a flock resistant to leukosis states that although it seems possible to achieve a substantial measure of success the financial expenditure involved is likely to be beyond the means of most breeders. Greenwood and Carr (1951) had previously questioned the advisability of breeding for resistance to any one form of the leukosis complex on the grounds that it might lead to an increased incidence of other forms of the complex, since their work had indicated that resistance to Sarcoma was accompanied by an increased death rate from neural lymphomatosis. The position is even further complicated by the fact that Waters (1954) challenges the concept that neural and visceral lymphomatosis are aetiologically related and produces additional evidence that neural, visceral and probably ocular lymphomatosis and osteopetrosis are distinct entities responding differently to genetical and environmental changes. This conclusion would go far to reconcile the views of the Cornell workers, Cole & Hutt (1951), who were unable to confirm the results of the East Lansing workers, Cottral *et al.* (1949) on the egg transmission of lymphomatosis, if the two groups of investigators had been working with a different disease entity. Waters (1954) suggests that it is reasonably clear from their data that Hutt & Cole (1953) are working predominantly with neural lymphomatosis and that their conclusion might be changed to read "little evidence could be found for the theory of egg transmission of *neural* lymphomatosis." Cottral (1952) in a paper presented to the 89th Annual Meeting of the American Veterinary Medical Association and entitled "The Enigma of Avian Leukosis" provides an excellent summary of the existing knowledge on this widespread and major cause of avian mortality

and of the massive literature on the subject. On the debatable question of egg transmission he states that there is now direct proof that *visceral* lymphomatosis can be transmitted through the egg from one generation to the next and that certain clinically normal birds may be carriers of the agent but that the relative importance of egg transmission compared with infection acquired in the brooding stage has not yet been established. Burmester (1952) states that "visceral lymphomatosis is a contagious malignant neoplastic disease caused by an agent which has many of the properties of the common virus. This agent is spread by direct contact and probably by the aerogenous route. It is also spread from parent to offspring through the embryonated egg and is found in a latent state in many apparently normal adult chickens." Cottral (1952) makes the interesting suggestion that lymphomatosis could be inadvertently transmitted by live virus vaccines prepared from embryonated eggs, a point to be borne in mind in relation to Newcastle disease policy. The greatest incidence of lymphomatosis usually occurs when birds are raised in large groups on built-up-litter pens and the lowest, when the birds are reared in small groups in isolated pens. This environmental effect may be related to a "trigger factor" capable of precipitating the tumour formation in birds infected with the aetiological agent (Cottral 1952). Predisposing factors such as coccidiosis and nutritional deficiencies have been previously postulated. All attempts at therapy and prophyllaxis have so far proved unsuccessful but Darcel (1953) and Chubb and Laursen (1954) have reported that the synthetic derivatives of pterolgutamic (folic) acid, aminopterin and amethopterin exhibited some tumour inhibiting action and an increase in survival time when injected intraperitoneally or fed to chicks artificially infected with transplantable lymphoid tumours. Although the results were complicated by the toxicity of these two folic acid antagonists, their toxic effect could be overcome by synthetic citrovorum factor but which in its turn blocked the tumour inhibiting action.

As already explained the absence at laying trials of other infections has made it impossible to assess the relative incidence of other avian infections. Experience from diagnostic laboratories, however, indicates that these are: the egg borne diseases, pullorum and other Salmonella infections; the protozoal infections, coccidiosis and blackhead; fowl typhoid, respiratory infections and nutritional disorders and deficiencies.

Therapy of Certain Poultry Diseases

It is manifestly impossible to deal with the whole of this avian disease spectrum and one can only "cull" from some recent publications. Considerable strides have been made in the therapy of poultry diseases and an attempt was made to summarise the present position by Gordon (1954). The main advances have been in respect to the prophyllactic control of the protozoan diseases, coccidiosis and blackhead and the use of Sulphaquinoxaline either in the food or water (Horton-Smith, 1951 & Wilson, 1951) of nitrofurazone (Horton-Smith & Long, 1952) for coccidiosis and of Enheptin-T (Horton-Smith & Long 1951) for blackhead are now well established in this country. Davies & Kendal (1954) indicate that with sulphonamides an intermittent schedule of treatment in which the drug is fed for 3 days, withdrawn for 2 days and fed again for 3 days is preferable to continuous treatment and that high concentrations of the drug inhibit the development of early stages of the parasite and interfere with the production of immunity. Accounts have also appeared of a condition in chicks suggestive of sulphonamide toxicity (Gordon, 1951, and Davies & Kendall, 1953) but the exact factors responsible for the condition are by no means clear and it is unlikely that the condition is a straightforward toxicity. Furthermore, a haemorrhagic condition resembling the avitaminosis K syndrome and cured by the addition of menadione, dehydrated alfalfa meal and fresh or dried droppings has since been reported by Anderson *et al.* (1954) in chicks fed on a simplified broiler ration and in which the addition of sulphaquinoxaline, penicillin or nitrosol did not appear to influence the occurrence or severity of the disease. Gordon *et al.* (1953) showed that the feeding of nitrofurazone continuously for sixteen weeks at a level of 0.04 per cent. had no detrimental effect on gain in body weight or subsequent egg production, although some slight reduction in hatchability may have occurred.

An even greater advance has been made in the case of pullorum disease mainly as a result of controlled testing under the Poultry Stock Improvement Plan. Blaxland (1954) has reported that from a nucleus of approximately 500 flocks officially tested in 1939 and of which 39 per cent. were infected there are now close on 4,000 flocks, 13 per cent. of which showed infection. This represents some 3½ million fowls of which only 0·17 per cent. were found to be reactors to the test. Even more impressive is the decrease in the incidence of pullorum disease in chicks based on the percentage occurrence of the disease in batches of chicks examined at the Weybridge laboratory. In 1935 pullorum disease occurred in 35 per cent. of the 400 groups of chicks examined and this figure has decreased considerably to in 1952 only 7.9 per cent. of over 2,000 batches investigated.

The position regarding infection with other members of the Salmonella group, particularly *S. typhimurium*, is far from a happy one. This infection can cause serious losses in hatcheries and in the author's experience is increasing in incidence in turkey poults. With the expansion of that industry and an increase in the use of cabinet incubators, typhimurium infection may well assume the proportions of pullorum disease in the 1930s. Routine blood testing has proved of little value in the eradication of infection from breeding flocks and although in a recent survey rectal swabbing of the breeding stock appears to have made promising progress in eliminating carriers, there are obviously serious economic and labour problems to be faced. At present, most emphasis must be placed on improved incubator hygiene, in improving the standards of clean egg production and in attempts to reduce infections spread by faecal contamination of the outside of the shells

of hatching eggs. Lancaster *et al.* (1952) reported that certain disinfectant solutions used at 25°C. efficiently removed *S. pullorum* from infected egg shells. In the last two years important observations have been made on the use of formaldehyde gas in the fumigation of hatching eggs and incubators, Wilson (1951), Lancaster & Crabb (1953) and Lancaster, Gordon & Harry (1954). The results indicate that the lower strengths recommended in the regulations (1954) of the Poultry Stock Improvement Plan is below the minimum level for complete bactericidal effect and the higher strength just on the minimum level. Allowing for cracks in the machine, badly fitting doors, etc., it is suggested that between 100-150 c.c. of formaldehyde per 100 cu. ft. of incubator space is required depending on the air-tightness of the machine and this is nearly twice the officially recommended strengths. For pre-incubator fumigation of eggs at room temperature and humidity exposure to 150 c.c. of formaldehyde for 10 minutes or 100 c.c. for 20 minutes was effective in a sealed chamber.

Increase in Fowl Typhoid

Fowl typhoid, a disease at one time more or less restricted to Wales, the south-west and bordering counties, has shown a serious increase in incidence in recent years and has become well established in the N.E. Riding of Yorkshire and in the north and north west Midlands. Blood testing as a means of controlling the disease, although theoretically sound has been inconsistent in effect in the field and in some instances disappointing. Stock vaccines, although widely used have proved of limited value. Sulphonamides, particularly sulphamerazine, do reduce losses but are only bacteriostatic in effect and cessation of treatment is invariably followed by a recrudescence of the disease. Furthermore, sulphonamide therapy results in the production of a high carrier rate with subsequent interference with routine pullorum testing. Williams Smith (1954) has shown that when artificially infected chickens were treated with furazolidone in the mash at a level of 0.02 per cent. for 6-12 days there was a survival rate of 98 per cent. compared with a mortality of 77 per cent. in the untreated controls. Only one of the 88 treated chicken which survived infection became a carrier and excreted *S. gallinarum* in its faeces and only one (the same bird) gave a positive reaction to the routine pullorum blood test. All the untreated survivors were blood test positive and faecal excretors of *S. gallinarum*. Further field trials are in progress. Laboratory studies nearing completion indicate that this drug may be equally effective in the treatment of pullorum disease and other salmonella infections. It may even help in the solution of the difficult problem referred to of the adequate control of salmonellosis in turkeys and may prove a useful adjunct to pullorum testing by reducing the carrier rate in infected flocks.

The complex and complicated story of respiratory infections in poultry is beyond the scope of this paper, since the disease entities contributing to the problem are infectious bronchitis, Newcastle disease, infectious laryngotracheitis, chronic respiratory disease, mycotic infections and avitaminosis A. All of these are known to occur in England and Wales but omitting Newcastle disease which is dealt with by statutory legislation, the most important appear likely to be chronic respiratory disease (C.R.D.). Van Roekel (1952a) states that the disease is of great economic importance in the United States of America, particularly in the congested broiler-raising areas. Although the aetiology is uncertain, coccobacilliform bodies or pleuropneumonia-like organisms have a possible relationship to the causal agent. Although it cannot be stated with finality that they are one and the same disease there is apparently a relationship between C.R.D. of chicken and sinusitis in turkeys. Chu (1954) in the course of a survey on coryza has found that a chronic coryza associated with cocco-bacilliform bodies and similar to C.R.D. of chickens is present in many parts of England. Our experience, based on routine *post-mortem* examinations, suggests that a mild coryza presumably associated with *Haemophilis gallinarum* infection also occurs commonly in this country, but may be so transient that no diagnostic action is taken. The salient features of C.R.D. are nasal discharge, progressing to caseous pus in the nasal sinuses with swelling of the face, respiratory râles, slow rate of spread and persistency of symptoms often accompanied by decline in egg production and loss of body weight. In advanced cases there may be a spread of infection to the thoracic and abdominal air sacs. The mortality rate is variable but may be as high as 20 per cent., although Van Roekel (1952a) refers to a mortality level of 75 per cent. Environmental conditions such as poor ventilation, overcrowding, and nutritional deficiencies may influence the course of an outbreak. Although the disease mainly appears to spread by direct contact with infected birds and indirect contact with contaminated equipment, feed, water, etc., there is some suggestion that the agent may be egg transmitted even although clinical evidence of the disease may be absent from the breeding flock concerned. It is suggested that live egg-propagated Newcastle disease vaccine may be responsible for some spread of infection or even of lighting up latent infection. The C.R.D. agent is sensitive to streptomycin, auromycin, teramycin and chloromycetin (Simms, 1952) but Van Roekel (1953 B) states that there is no sound basis for the recommendation of antibiotics in the prevention or control of C.R.D. and that reliance should be placed on depopulation. In our experience the disease if tackled in the early stages responds to the intra-muscular injection of streptomycin at the level of 50 m.g.m. per kilo. The mild type of coryza has been known for many years to respond to the use of sulphathiazole in the drinking water. The variable results obtained in the field with therapy are probably due to the fact that coryza of either type may frequently be complicated by other respiratory infections or environmental factors.

Newcastle disease

The position regarding Newcastle disease has followed much the same pattern for the last 3 or 4 years since the recognition of the sub-acute form of the disease in this country, the peak incidence

being reached during the late winter and early spring, followed by periods of comparative freedom from the disease. The present policy of compulsory notification and slaughter has undoubtedly effectively controlled, if not entirely eradicated the acute form of the disease. Considerable doubt has arisen in certain quarters, however, as to whether the existing policy can be equally effective in the eradication of the sub-acute form and a section of the industry favours the abandonment of the slaughter policy and its replacement by immunisation. The pros and cons of the problem have been discussed mainly in the trade Press. It is unfortunate that the subject has not been ventilated in the scientific Press for many of the arguments advanced in favour of immunisation are based on American experience. Much of this may be misleading and has led to misunderstanding for the position cannot be regarded as entirely analogous with that in the U.S.A. where the disease existed for some 10 years prior to its recognition. It is sincerely to be hoped that the recent declaration of a clean area in Wales and the contiguous counties and of a restriction of movement order in mid-Lancashire will have the desired effect, for although the majority of the industry support the present policy it is doubtful whether the industry could continue to face the interference with normal trading methods and the hardships which inevitably follow the restriction of stock movements. It has been claimed by those who advocate a change in policy that Newcastle disease is endemic in England and Wales and so widespread as to render eradication impossible. It is encouraging to find that the recent Press statement from the Animal Health Division states that a survey carried out by them failed to disclose widespread latent infection and that they consider the over-all position to be satisfactory and encouraging.

Intensive Management Systems

It is possible that the continued trend towards intensivism may further influence the disease position in the poultry industry. Coles (1954) estimates that 35 per cent. of the poultry in this country are housed intensively and that in a few years' time this proportion will have increased to 50-70 per cent. The author (Gordon, 1954) speculated on the impact of intensivism on disease, with particular reference to the increased use of the built-up-litter system. Work on this subject is in its infancy and evidence is lacking on many points. Our observations, however, indicate that although this system of management has many advantages to offer it presents all the disease hazards of other forms of management, in some cases, intensified. It is possible that under optimal conditions the system may be of some advantage in the control of coccidiosis (Horton-Smith, 1954) but it definitely favours round worm and red mite infestations. As Horton-Smith points out "what is poison to coccidia may be food to the host of other undesirable organisms." There is little concrete evidence of the part this system of management may play in the occurrence of leukosis but Cottral (1952) points out that the greatest incidence of leukosis occurs when birds are raised in large groups on litter pens and it may be of some significance to note that in the progeny sections of the Poultry Production and Progeny trials which are housed in built-up-litter units, the incidence of leukosis is more than twice that in the parent', housed in small semi-intensive pens.

There seems to be little doubt from the American literature that the increase in respiratory disorders, particularly C.R.D., is related to a large extent with the densely populated broiler areas where the birds are mainly housed on this system. It would seem reasonable to assume that fungal diseases are likely to increase in severity under these conditions, and vices such as cannibalism, feather pecking and egg eating are much more prevalent in intensively housed poultry. Intensivism has brought in its wake the need for prophyllactic medication, as Levine (1952) has termed it "Pharmaconutrition" with all its attendant risk and possible side effects. Space precludes reference to nutritional disorders and deficiencies but it is obvious that the greater the degree of intensivism the more essential the need for exact, adequate and carefully balanced rations. Probably in no branch of livestock management has nutritional research made such strides yet "outbreaks" of avitaminosis A, rickets, curl-toe paralysis, chick dermatitis, curl tongue and so-called "crazy chick disease" are by no means rare. Finally, although well-managed built-up-litter units appear to be highly efficient, probably no system of management in our experience is so open to abuse.

There is obviously a vast field of research still to be covered in avian pathology and many of these problems are of urgent economic priority. It is disturbing to find, therefore, that the total research expenditure from official sources in the United Kingdom on all aspects of poultry husbandry including disease was less than £100,000 for the year 1952/53 or only approximately 0.04 per cent. of the annual value of the commodity (A.R.C. 1953). This sum compares most unfavourably with relative research expenditure on other branches of agriculture.

Veterinarians and the Poultry Industry

The other point which requires to be stressed is that referred to in the opening paragraph of this paper, the responsibility of the veterinary profession to the poultry industry. Admittedly, the relatively few poultry pathologists have produced much valuable work on the aetiology, epidemiology, treatment and control of the commoner diseases and in recent years the State veterinary service has devoted a fair share of its time and manpower to this industry, particularly in those diseases dealt with by legislative control or stock improvement schemes. Nevertheless, one feels that as a whole the industry has not received a proportion of the profession's attention commensurate with its position as the second most important branch of livestock and with the magnitude of its disease problems which are likely to increase with further expansion and intensivism.

The advent of specified compounds which can be administered by mass treatment in the drinking water or food has largely changed the picture of avian disease control and has made the inclusion of

poultry an economic and practical proposition in veterinary practice. Furthermore, specific therapy has increased the need for accuracy in diagnosis and a closer link between the practitioner and the diagnostic laboratory would be of the greatest value.

The large poultry breeders, hatcherymen, egg and table bird producers are amongst the most enlightened of livestock owners and are well aware of the need for preventive control of disease rather than clinical treatment and are eager to obtain authoritative advice in the field on hygiene and eradication programmes, and nutritional and husbandry problems on a flock basis.

The tendency has been in the past to rely mainly on advice from laity although in fairness to them it must be admitted that our profession has failed to shoulder its responsibilities and has not gained the confidence of that industry, and the lay advisor has been the only source of information to the farmer. The diagnosis, treatment and control of disease whatever the species of animal involved is the responsibility of the veterinarian and there must be no tendency as in the past to delegate this duty to others.

Our training in the basic sciences enables us to deal equally with any species of livestock and it is only a question of applying that knowledge to the specialised type of husbandry involved. It is in this respect that we appear to have failed for as Goldhaft (1951) pointed out, "even recently graduated veterinarians have not been properly indoctrinated with the importance of poultry practice by the veterinary colleges. Emphasis has been confined to small and large animals and to State employment. Whatever the reason, it has reacted thus far to the detriment of the veterinary profession and the poultry industry. Immediate steps should be taken to create a proper approach to the subject and to include a comprehensive course of study of domestic birds in all veterinary curricula."

The dearth of veterinary graduates prepared to devote their lives to poultry research is equally serious. This is even more difficult to understand for no branch of veterinary research offers such a wide field of study, much of it still virgin country, and in the field of human and other animal disease the fowl as an experimental animal has been of great service to humanity. The embryonated egg serves as a classical tool in the study of biology and embryology and in the investigation of many human and animal diseases, particularly those of viral origin. The chick has now taken its place with the rat as a most useful instrument in nutritional research and biochemical assays, while genetical studies with the fowl probably exceed those in any other species.

Summary

The poultry industry in Great Britain is now the second most important branch of livestock production, with an annual income of £147,000,000, representing 12 per cent. of the total agricultural production. The total poultry in the U.K. is estimated to be 92,200,000.

Analyses of mortality at laying trials indicate that the present mortality level from day old to the end of the first laying year, exclusive of infectious diseases, is approximately 20-25 per cent. and that the mortality levels over the period of years reviewed suggests that it bears some relationship to the expansion of the industry. An attempt has been made to estimate the economic loss from disease based on egg laying trial records and it is suggested that the monetary loss to the industry must approximate between £16,000,000 and £20,000,000 annually.

Undoubtedly, the most serious single cause of the mortality is the leukosis complex. This disease accounts for some 30 per cent. of the losses during the first laying year. A brief review is given regarding the aetiology and epidemiology of this complex, and again evidence is presented to suggest some relationship between the national poultry population and the incidence of the disease.

Other major causes of loss dealt with are the egg borne diseases, reference being made to the progress which has been made in the control of pullorum disease under the Poultry Stock Improvement Plan and the relatively important part which is now being played by other Salmonella infections as a cause of losses, particularly in baby turkeys. Reference is made to advances in the therapy of poultry diseases.

Reference is also made to chronic respiratory infection as a possible major cause of loss with the increasing trend in the industry towards intensivism and also the effect which this may have on the incidence of disease generally.

Finally, attention is drawn to the responsibility of the veterinary profession to this important branch of agriculture, and to the need for the inclusion of a course in poultry diseases and their control in the veterinary curricula.

Reference is also made to the relatively small expenditure on poultry research compared with that on other branches of livestock production.

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THE OPENERS' SPEECHES

Dr. W. P. Blount, opening the discussion, said: May I say what a pleasure it is to be invited here to-day to open the discussion in conjunction with Mr. Reid, and secondly what a splendid choice the Committee made in choosing Dr. Gordon to present this paper.

I am here not only as a veterinary surgeon, perhaps a metamorphosed one, but as one who has a wide contact with the industry as such, and I am presenting their side of the problem as well as your own. The idea that mortality runs parallel with the poultry population is a common one and it is not really quite true in the sense that we have a larger poultry population to-day than we had in 1936 when the mortality was reaching 18 per cent. and to-day it is between 10 and 15 per cent. For example, Dr. Gordon quotes in his paper a level of 9 per cent. and 14 per cent. mortality at deep litter and hen batteries in the Bristol survey, which is good proof that mortality is not always parallel to the numbers concerned. At Stoke Mandeville we have been running laying trials since 1946, using 1,000 laying pullets annually from 150 different breeders, and our mortality has remained static at between 12 to 14 per cent., yet there are 30 per cent. more birds to-day than there were in 1946. It is obvious, of course, that with the increase in the size of the industry, the greater is the chance of spreading infectious diseases; and if breeders are perpetuating "susceptible" stock the diseases concerned will increase with the size of the industry. Much depends upon the efficiency of the poultryman and on his husbandry methods.

Dr. Gordon is perfectly correct in indicating the very high sum which is lost annually to the industry, as a result of this mortality reaching many millions of pounds sterling, but that is not the only loss. I will give you a specific example. We were struck with fowl pest a couple of years ago in December and by the time we were cleaned up and ready to start we had to find in February 1,000 laying pullets which is not easy. We did find them, of course, they were retained from February until August before they were disposed of and as a consequence our net income from those birds was only about half that which would have transpired had we been able to use them throughout their full pullet year. Not only therefore is there a tremendous loss in terms of actual cash because of death due to compulsory slaughter but there is the subsidiary loss in terms of eggs. It is also true that the loss occasioned by those diseases which strike at stock when they are at point of lay is great because they have been reared at considerable cost and are lost before they earn any income.

Let us take the fowl paralysis group alone. A farmer is suffering a 10 per cent. or 20 per cent. loss of his fowls; he goes to the veterinary practitioner but what help can he give him? There is nothing we can do, it cannot be prevented or treated. If he is a breeder something can be done, but if he comes to you with deaths at the laying stage nothing can be done unless by chance the practitioner believes in Gray's theory of inoculation with iodide of potassium.

Dr. Campbell was correct in his paper at the World Poultry Congress in Edinburgh recently in endeavouring to clarify the Avian Leucosis Complex, and to separate osteopetrosis and true fowl paralysis from the other members of the leucosis complex, but that does not help the farmer. Dr. Gordon's suggestion that the pathologists of this country should get together to discuss the subject is excellent but it still leaves the farmer where he was, his birds are dying and nothing can be done about it!

Further Causes of Loss

The next greatest cause of loss is diseases of the reproductive system. This term covers a multitude of sins. Here, again, the practitioner can do almost nothing. He can, of course, deal with cases of prolapse and cannibalism but these do not form a high percentage of cases. He cannot do anything about egg peritonitis or "internal laying," oviductitis or multiple ovarian cysts. At one time it was thought that many of the common diseases of the reproductive system were due to rough handling or birds jumping from high perches, or vacating trap nests in an awkward manner, but that is quite untrue. When birds are housed in hen battery cages they do not jump from perches, nor are they handled, but they still suffer from the same high incidence of these diseases. There is some evidence that such diseases run in strains, and if you care to peruse the Report of the Fourth Random Sample Laying Trials 1954, New York, you will see some evidence that these diseases appear to run in certain breeding stocks much more than in others.

The third major cause are the cancerous tumours and blood blisters for which also there is no treatment. There is the leukaemia complex, for which the practitioner can do almost nothing. Next there is the nephritic group of diseases. We do not know the cause of these except that some practitioners insist that it is due to the feeding of a certain proprietary food! Perhaps they are not aware that this disase is world-wide in extent. We have this "pullet disease" in Holland, Denmark, Palestine, Australia, America and Canada and I do not think that this particular food goes to all those countries! There is now some suggestion that it is of virus origin, if note is taken of recent Japanese researches. The best treatment is molasses in the drinking water. If you are a theorist you will feed potassium salts, if you are a practical man you will feed molasses which already contains potassium.

There *is* an important place for the veterinary practitioner where poultry diseases are concerned but it is more in connection with husbandry than with actual therapy; and when husbandry is concerned the practitioner has to think of the profit which the farmer is going to make, because the farmer only lives if he makes a profit. Incidentally, where cases do arise where the practitioner feels that a certain food or other product is at fault I am sure that food firms and manufacturers will welcome co-operation with him in any investigations to be carried out. This, of course, is already being done on many occasions. This is essential, because if the practitioner diagnoses, for example, perosis and recommends additional manganese (sometimes he gives magnesium in error), he may be putting his finger on the wrong button, because it might be choline or biotin. For rickets he often gives cod liver oil, whereas it may be the calcium or phosphorous which is at fault.

One of the most interesting pieces of research carried out in America on chick nutrition, is the work of Singsen and Jungherr relative to the vitamin E story. Most people believe that when chicks show cerebellar symptoms it is due

to a deficiency of vitamin E, Singsen and Jungherr have shown that the actual requirement of vitamin E is very low and it is only when unsaturated fatty acids are present in quantity that this may lead to encephalomalacia and it is then that the vitamin E requirement is increased. Vitamin E can be added to the feed in synthetic form as practised by some compounders. It was found that diphenyl-para-phenylene-diamine was effective for controlling this disease but they found that butylated hydroxy anisole (B.H.A.) was ineffective. They wanted to know whether the final product was effective in the food or in the tissues as such. It is thought now that it is the latter because although the product was comparatively insoluble, soluble forms were injected and good results were obtained. It was also found that 1 to 2 per cent. of fish liver oil in the diet was sufficient to precipitate encephalomalacia and it seems that it is stress factors which are important as well as the level of vitamin E in the diet. One hopes that extended use of properly compounded foods will play a useful part in preventing many of these nutritional deficiencies occurring, many of which have characteristic symptoms, but there are pitfalls.

A practitioner may have birds brought to him showing multiple haemorrhages and he may diagnose deficiency of vitamin K without any though as to whether vitamin K is present in the diet, and whether the factory of the intestines is synthesising them. He may see some crazy chicks and think only of a deficiency of vitamin E, whereas it may be a virus disease. There is often confusion between Curled Toe Paralysis of vitamin B_2 origin and "Crooked toes" of genetic and management origin. I am merely mentioning these cases because they are easy to confuse in the field. One of the best reports on this whole subject of poultry diseases is Dr. Gordon's article in the M. & B. Review, and for those who have not seen it, it is well worth reading.

Coccidiosis

Another belief is that good husbandry will prevent coccidiosis. I wish it were true. I know something about good husbandry, we thoroughly clean our pens, we use the best of everything possible, and we still get coccidiosis. The diagram downstairs shows chicks dying from coccidiosis, they have a beautiful red comb yet they have passed blood and should be anaemic, and if the profession is prepared to tolerate that type of diagram there is something wrong. Now as to the prevention of coccidiosis by medication. Some may wonder whose job it is to medicate, the practitioner, the farmer or the food manufacturer. It does not matter so long as the chicks get the medicated food. The practitioners like to give it because it means more income for them. This year we have medicated certain of our poultry feeds with nitrofurazone at a 0.005 per cent. level. It is a low level and not necessarily the ideal level but that is the level which has been used this season in large quantity, indeed, we have probably fed over one million chicks in this manner—and I mean one *million*—and the number of subsequent outbreaks of coccidiosis have been extremely small. There are, some conclusions we can come to as a result of that type of experiment. Obviously, the ideal experiment is to feed it to individual chicks with controls, but when you feed one million chicks on many thousands of farms, it is a pretty useful experiment. The conclusions appear to be as follows:

(1) This level of the drug (0.005 per cent.) does give a considerable degree of protection and when the disease does break out it is in a less virulent form. In our case we recommend that sulphaquinoxaline should be used and the total mortality will then not exceed 5 per cent. When that is contrasted with the 80 per cent. mortality of a typical outbreak it will be seen that a very different picture is presented.

(2) Nitrofurazone does not interfere with growth and at the level mentioned shows no toxic effects up to 12 weeks of age.

(3) When caecal coccidiosis does occur the symptoms are milder and of shorter duration.

(4) There is good reason to believe that if nitrofurazone was given at double strength, that is at 0.01 per cent., we should have even better results but it automatically doubles the cost to the farmer.

Now to come to a more specific experiment. We recently carried out a table poultry farm competition in which 34 farmers in all the counties of the country, each brought up 100 chicks with the object of seeing what weights they could achieve by 12 weeks. The sole feed used was one containing 0.005 per cent. nitrofurazone. Out of 3,400 chicks the total mortality was 2.87 per cent. (95 chicks), of these only eight died from coccidiosis, so that this drug does give a very useful degree of protection. The average weight of the birds at 12 weeks was 4¼ lb., and their feed conversion was 3.15.

With regard to blackhead *prevention*, it is not always realised that Entramin must be used throughout the whole of the growing period otherwise the birds are still sensitive to the disease. It is a question whether the farmer is prepared to pay for it throughout the full growing period or whether he prefers to wait until the disease appears. We have had birds to whom it had been given and which had been transferred later to a farm where they did not get any and within a month they had contracted blackhead.

With regard to sulphaquinoxaline poisoning we had an outbreak in our stock two years ago and we therefore tried to reproduce the condition in 9 to 16 week old cockerels, on diets both with and without vitamin K. We gave them full strength sulphaquinoxaline in their drinking water, we waited a fortnight and gave it for a further three weeks but we did not have any trouble. We increased the dosage daily until they stopped drinking, and we still did not have any trouble! Then we tried to induce nephritis as well because I believe that very often nephritis is present at the time of outbreaks of so-called sulphaquinoxaline poisoning. We gave them an organic mercurial seed dressing preparation but not one bird died. There was no sign of haemorrhage in either group. We checked the blood clotting time and where those of the controls were under three minutes, those fed on a vitamin K deficient diet exceeded 25 minutes.

The Use of Furazolidone

The latest American drug, Furazolidone, which Dr. Williams Smith has studied also appears to have tremendous possibilities in blackhead and hexamitiasis. In connection with this latter disease one farmer we knew had lost between 300 and 500 poults this season and they were still dying. A diagnosis of coccidiosis had been made several times and the flock had been treated more or less continuously with one of the sulpha preparations to try to control it. We examined some of the birds and some did show a few coccidia, but in some we also found flagellates. We handed some over to Dr. Horton Smith who started to work on the problem. In the meantime we put the farmer on to three drugs, "Neftin," "Entramin," and "Megasul" and the losses in the Neftin group stopped almost the next day. The whole farm was changed over to Neftin and further losses ceased. Whether or not the diagnosis was correct, the therapy was wholly successful. I hope that some of the profession who are dealing with furazolidone in the field will speak in the discussion, because there is a suggestion that it is not so effective in the field as it is in the laboratory.

Dr. Gordon was wondering whether the mycotic infections were increasing as a result of deep litter production or following the use of penicillin but that has not been our experience. With the deep litter system you may get a great increase in vices.

For duodenal coccidiosis there are other products than nitrofurazone to be used, one such production has proved valuable, experimentally, a nitro-phenide preparation, "Megasul," in conjunction with high level dosages of Aurofac 2A (50 grammes per ton). This has been used on two or three farms where there have been extensive outbreaks with very good results.

In laying trials the competitor normally sends from six to 12 pullets, supposedly representative of the stock. We carried out rather an interesting experiment last year, we bought a couple of hundred Sussex pullets to act as controls housing them in the laying trials and we were amazed at the results. The production in the trials proper was 173 eggs per bird, and the mortality was 17 per cent.; in the Sussex birds the production was 191 eggs with a mortality of 12 per cent. The birds were divided at random into groups of

six pullets and the egg production varied from 123 per bird to 202. If one could have found the six best Sussex birds they would have won the trials. 23 teams had no mortality, eight lost two out of six; three lost two out of six, and one lost four out of six, so that there is not a great deal of faith to be put in ordinary laying trials. Whether one loses or wins, or who may be at the top or the bottom, is often just a matter of luck. On the other hand, if a particular individual wins year after year there is much more to be said for such a breeder. One farmer I know has done very well consistently, but the sending of a mere six birds to a trial once is no criterion of a man's stock; in "random sample" trials where the birds are randomised in groups at day-old it is a very different story.

With reference to Dr. Cole's remarks at Edinburgh relating to the training of veterinarians in poultry matters, it is such a large subject that it wants to be discussed separately. I wonder perhaps whether we are right in giving poultry husbandry to students during their five years' course or whether the student should not spend three or six months *after* graduation concentrating solely on poultry matters if he intends to go in for poultry.

Mr. John Reid (Tolworth), also opening the discussion, said: In agreeing to assist in opening the discussion on this paper by Dr. Gordon, who has such a wide experience of poultry diseases, I cannot but admit some diffidence. However, my job is to comment on the Paper and in doing so I will confine myself to those parts of it which deal with the problems that face us in Animal Health Division in our efforts to assist with the control of poultry disease. It is with that background that I make my contribution and I make no excuse for it—for the field application of the result of the work of the research institute must always be the most important part of disease control.

The Ministry's field work divides broadly into two main sections; the disease control required under the Poultry S.I. Plans and the Scheduled diseases.

The most spectacular progress has been in the control of pullorum diseases in accredited flocks and Dr. Gordon has drawn attention to this success in England and Wales. It is appropriate to emphasise that the work in Scotland has been even more successful, for in 1953 infection was disclosed by the blood test in only 79 flocks out of more than 1,000, an overall percentage of .12 reactors. This has not been achieved without some difficulty and it has entailed changes of technique from the serum agglutination test in the laboratory to the rapid whole blood test in the field carried out first by the whole-time veterinary staff and since 1945 by lay testers specially appointed and trained for the purpose and working under veterinary supervision.

We must not be complacent about this progress; many breeding flocks still remain outside the control of official schemes, and in these blood testing may be either lacking altogether or erratic. Ultimate eradication will depend on all breeding flocks being tested for carriers of the disease and on some form of regulation to improve hatchery hygiene.

Dr. Gordon has recorded the unhappy situation over salmonellosis and I agree with him that this infection is becoming an increasing worry to us, particularly in turkeys. I agree also that routine blood testing has great limitations and I think that although it may be combined with bacteriological examination of cloacal swabs, this is an almost impossible exercise and could never be applied in a general way.

In any event the egg laid by a bird with alimentary infection, should its shell be contaminated, ought to be adequately dealt with by fumigation either before incubation or shortly after setting. Where the disease persists in spite of good fumigation, the possibility of direct egg transmission must not be overlooked and in these cases we must resort to the agglutination test. A laying bird with ovarian infection generally shows a positive result with a significant titre. Fundamentally control of salmonellosis presents quite a different problem from pullorum infection because it does respond in many cases to improved incubator hygiene. Dr. Gordon is critical of the concentration of formaldehyde gas as recommended by the Ministry in the Regulations of the P.S.I.P., because he has found under experimental conditions that it does not completely sterilise. It may be that under artificial conditions the lower strength recommended in the Regulation has not always been bactericidal but my experience is that under field conditions it has been generally effective and it should not be assumed that a recurrence of the disease is necessarily associated with imperfect fumigation. I doubt very much whether good fumigation up to the recommended strength is practised uniformly throughout the hatching industry now, and in any case it might well be difficult to persuade owners and employees to agree to use the greater density of the gas.

The various forms of lymphomatosis (neural, visceral and ocular) and leucosis present to us in the field an almost insuperable problem, and it is often difficult to give advice when the disease makes an appearance.

It now seems that there are sound grounds for considering the several types of fowl paralysis and leucosis, not as manifestations of a single disease but as separate entities and of different causation. Recent work by Burmester and Gentry (1954) has shown that the causative agent of visceral lymphomatosis is present not only in the discharges of affected birds but in the oral secretions and faeces of apparently healthy birds, which may therefore be carriers of the disease. There is also irrefutable evidence that the visceral form of fowl paralysis may be transmitted through the egg (Cottral, Burmester and Waters, 1954).

Dr. Gordon has made a strong *motif* of breeding for resistance and has pointed out the attendant difficulties. It would appear however that some poultry farmers have succeeded in increasing the resistance of their flocks by breeding from hens which have survived an outbreak of the disease.

Much can be achieved by rearing chicks even from a susceptible strain well away from adult birds during the first few weeks of life when susceptibility is greatest. This applies particularly to the neural type; at present there is no means of assessing the extent of possible egg transmission of the visceral type and isolation may appear less effective.

Fowl typhoid has recently become a greater problem both in its wider geographical distribution and in the increased virulence of the causative organism. World wide experience of vaccination is disappointing. In this country vaccines prepared by various techniques, which give complete protection in some experimental animals, have proved ineffective in the fowl.

Field experiments with furazolidone are being carried out at several centres; while it is too soon to attempt to assess results it can be said that the response in some natural outbreaks has been less promising than in the artificially produced disease.

I am bound to disagree with Dr. Gordon's observation on the use of the drug for reducing the carrier rate in flocks infected by *S. pullorum*. It is fundamental to eliminate carriers of any disease for which a reliable diagnostic test is available—we have a good test and we should use it.

Fowl Pest

The most important scheduled disease of poultry is fowl pest—a term we use for convenience to include fowl plague and Newcastle disease. It is the latter infection we have experienced in Great Britain.

The form of the disease which came to this country in 1947 in poultry carcases from Europe was a peracute type caused by the Asian strain of virus and the slaughter policy with scrupulous disinfection of the infected premises was entirely successful in eradicating it so soon as legislative action had been taken to ban imports of carcases and live birds from dangerous countries.

This type of the disease has been succeeded by a subacute or milder infection, first diagnosed in East Anglia in 1950, in which symptoms are often not more spectacular than those of other respiratory diseases. The disease is similar to the type prevalent in North America. Morbidity and mortality vary considerably; the death rate in young stock is often about 15 to 20 per cent. at the time of slaughter. Obviously with a disease in which the symptoms are not always clear cut there may be a tendency for the reporting of suspected cases by owners to break down and the slaughter policy meets difficulties; it has even been suggested that the disease is endemic in some parts of the country and in 1953, a survey, based on the results of H.I. testing of 10 per cent. of over half a million fowls from nearly 3,000

premises, most of them in countries in which the history of the disease showed that we might expect some latent infection, was undertaken. Less than 1 per cent. of positive reactors were found in all birds tested and bloods from 98 per cent. of the holdings gave wholly negative results.

This figure should go far to allay any fear that there are numerous cases of undisclosed disease and our records show that in many parts of the country primary cases of fowl pest are indeed rare. In Wales, Monmouthshire was selected for survey on account of previous freedom from the disease and no positive blood samples were disclosed. A fairly consistent feature of the primary outbreaks has been their geographic distribution with the greater weight of infection in the Home Counties, East Anglia, and Lancashire and in 1954 the Ministry decided to ban movements of poultry except day-old chicks and eggs into the whole of Wales and the West Midland Counties of England. It is very significant that in almost eight months of the operation of that ban only two primary cases have been confirmed in the "clean" country. It is also relevant that there have been no outbreaks confirmed in Scotland in the last three years following the ban on the movement of all live poultry, day-old chicks and hatching eggs into Scotland in December, 1950.

The logical corollary to this policy of isolation of different parts of the country is a strenuous concentration of effort in the areas not protected by the ban and this means an intensification on the part of the owners and others in reporting any suspicion of the presence of disease. To this end the Ministry has given the widest publicity.

The Vaccination Policy

In some quarters vaccination has been put forward as a desirable alternative to the slaughter policy; there is no doubt that several efficient vaccines are available and under certain circumstances, *e.g.*, those which prevail in the U.S.A. —the use of a vaccine is well justified. There are many serious drawbacks to vaccination in this country; the varying and comparatively short immunity produced would mean that a fowl in its breeding life would require to be vaccinated on several occasions. To be effective a very high proportion of the poultry population would have to be treated and this would be quite unwarranted in a country in which the infection is not widespread. Moreover the use of a vaccine is by no means without risk for it has been shown beyond doubt that some vaccinated birds when challenged by a virulent virus at a time when their immunity is waning may excrete the virus although they show no clinical sign of fowl pest. The fact that all the vaccines for Newcastle disease are propagated in egg embryos raises the unhappy risk of introducing egg-borne diseases which already cause great trouble elsewhere and some of which are not as yet significant causes of loss in this country, and it is perfectly plain that if vaccination were introduced in this country the total of expense and trouble placed on the poultry industry would indeed be very great and out of all proportion to the present costs of control. It should be clearly understood once a policy of vaccination is instituted in a country that the poultry keeper is committed to it for an unpredictable period, and while this is true, it is noteworthy that in some places where vaccine is extensively used it is officially regarded as but a step towards the ultimate goal of eradication by other methods. In Great Britain the present policy is one step ahead and gives a better hope of success to this end.

Finally, may I congratulate Dr. Gordon on the competent manner in which he has dealt with his subject. I would like to associate myself with the strong plea he makes for a greater interest on the part of the veterinary surgeon towards the poultry industry. When I was employed in the North West of England I noted a significant increase in the interest shown by the general practitioner—particularly in the younger age group—towards poultry problems, and I had the impression that this experience is confirmed by the increased amount of material submitted to laboratories by veterinary surgeons. This is a step in the right direction; the colleges can doubtless do much to encourage the interests of the undergraduate student—some have indeed done so by their admirable courses. But the problem is deeper than that—maybe it is fundamentally one of economics and if so the profession must do everything possible to overcome the difficulty and to assume its rightful interest and responsibility to a large and expanding industry.

THE GENERAL DISCUSSION

Mr. G. C. Brander (Berkhamsted) congratulated Dr. Gordon on his very interesting paper. He rather gathered from Dr. Blount that the veterinary surgeon might endeavour to be interested in poultry, but that the problems were so great that he was bound to get into difficulties. He did not think it was unique that the veterinary surgeon had to advise on a disease about which he could do very little. There were diseases in cattle and pigs, the origins of which were not known and the treatment of which was uncertain, but a useful service could be given in advising owners.

The Ministry and its field staff were taking a very active part in advising the poultry farmer. In 1942 the field staff were asked to carry out field work on poultry, and a number of inspectors went to Weybridge, rather shamefacedly, for training; but once they went into the field they found that poultry diseases could be a very interesting subject, and he was sure that many of them who had taken it up found the subject of wide interest. The V.I.O.s took an active part in disease diagnosis, the Animal Health Trust had been very active under Dr. Gordon, and there was still a considerable scope for the veterinary surgeon. A great deal would be gained if the veterinary surgeon carried out *post-mortem* examinations and, if he had been properly trained at college, he would know what to look for. He could tell the farmer who had had losses from fowl paralysis the theories and knowledge available on this disease and could suggest methods of control.

Those who were present at the World Poultry Congress must have been stimulated by the interest taken in this subject, and the Congress showed how valuable it was to collect together the people (workers) interested in one animal. Discussions covered poultry from the time the egg was laid until the egg was put in a box and sold, and the pullet or hen through its laying life. Every aspect of the bird was considered.

In the case of the pig, the cow, or the sheep, it was very seldom that the workers interested in all the facets of the animal's life came together.

Mr. T. Barton Mann (Weyhill) said he wished to congratulate Dr. Gordon most heartily on bringing to the notice of the veterinary profession the deep significance of this loss which was not easy to be borne by the farmer.

Was a proper perspective taken of these losses by those connected with the industry? After 30 years he had come to the conclusion that it was not by veterinary means alone that these troubles would be surmounted. It was also a question of what the nutritionist did, and he had had the view forced upon him that all was not well with the nutrition of the flocks of this country. He could not agree with the purely veterinary approach of Dr. Gordon regarding salmonellosis of turkeys.

By blood testing for typhimurium coupled with improved nutrition he had raised the output on three large turkey farms by over 30 per cent. and had cut losses by more than 50 per cent. This had been done within two years.

These were hard facts, and it was the results of his work which paid his salary and the wages of the people on the farms. He could not subscribe to the view that salmonellae infections would defeat them.

With regard to coccidiosis, in 1953 at one of these farms 11,000 poults were lost at a month old. This loss always occurred when the poults were moved from one brooder to another. This year he had not seen coccidiosis affecting the stock. This change had been brought about by nutritional means only for no drugs of any description had been used and no change made in the brooding equipment.

With regard to drugs for blackhead, a farmer told him a few weeks ago that he was spending £100 a month on drugs for 2,000 turkeys. No farmer could stand that economic pressure.

The whole question of disease had to be looked at fairly and squarely, and apart from the veterinary approach with its blood tests, disease diagnosis, and drugs, there was the field of nutrition. That did not mean expensive vitaminised foods, for very often what was needed was to push the

farmer back on his own resources of cereals and grass, make the stock rest the gut, and enable the fermentation induced by excessive feeding of stimulating diets to subside.

This was especially true in the case of young stock and his advice to the farmer was "Lay off protein food, go back to your own resources, give starchy food from your own growing and keep them quiet for a few days."

He was appalled at the amount of drugging going on. The antibiotic craze pointed to the bankruptcy of the nutritionist who turned out foods which had to be bolstered up with drugs to make them work. On the other hand, he could not absolve the veterinary profession from a certain amount of bankruptcy because it played into the hand of the person who wanted to push stock to grow too rapidly.

With regard to breeding for resistance to the leucosis complex, breeding was the work of the geneticist and although veterinarians might turn to breeding to produce a resistant strain his experience had been unhappy in this respect. He had bred one resistant strain but could not sell the stock because in breeding out leucosis he had bred in other undesirable characteristics.

Then there was the question of fowl pest. It had been said, that morning, that a good deal of success had been achieved in keeping the areas clean but this practice had put great hardship on breeders in other parts of the country who were not allowed by the restriction order to transport their stock to a clean area. He would take the case of Hampshire which had not had an outbreak for four or five months, yet all the breeders were restricted in their movement from their clean county into a "clean area." It was a financial loss to breeders in such counties that they could not obtain a licence to move their stock. The outcome would be the same as the 30-mile driving limit, that there would be a tendency to disregard the law. He thought something might be done in the way of issuing licenes to farmers who were "clean" in areas having low incidence of fowl pest, to enable them to transport their saleable stock direct to the clean areas.

Mr. K. D. Downham (Cirencester) wished to draw attention to two important comments op page seven of the Paper. It said: "Nevertheless, one feels that as a whole the industry has not received a proportion of the profession's attention commensurate with its position as the second most important branch of livestock and with the magnitude of its disease problems which are likely to increase with further expansion and intensivism." Two paragraphs lower down, Dr. Gordon said: "The tendency has been in the past to rely mainly on advice from laity although in fairness to them it must be admitted that our profession has failed to shoulder its responsibilities and has not gained the confidence of that industry, and the lay adviser has been the only source of information to the farmer. The diagnosis, treatment and control of disease whatever the species of animal involved is the responsibility of the veterinarian and there must be no tendency as in the past to delegate this duty to others."

He agreed with these observations and he did not speak without some knowledge, because for a great many years his main job was poultry disease control. Also, he had represented the Association before the Royal Commission on Eggs and Poultry which met under the chairmanship of Lord Addison and all were convinced, as he was sure were most of the leaders of the profession who had a knowledge of poultry disease in the country, that something should be done. It was then decided that something was going to be done, they were told that thousands of pounds would be spent which would help to prevent the enormous losses which then existed and which still exist and that the industry would put its house in order. Unfortunately, very little had happened and poultry diseases and poultry husbandry teaching at the veterinary schools left much to be desired.

Soon after that time he was in the Midlands and got a committee together at Birmingham University, in which the Vice-Chancellor of the University and the professors of Bacteriology, Pathology, Preventive Medicine, Physiology, Medicine and the Reader in Industrial Medicine as well as several eminent veterinary surgeons, including the Chief Veterinary Officer of Birmingham, and others interested in poultry were going to work as a team and tackle these problems. Unfortunately through the war nothing further happened except a small exchange of blood samples and so on, in connection with such diseases as leucaemia and the leucoses. There were, he believed, a great many people in the medical world who would like to get together and really tackle the disease problem in poultry on a broad basis as a team with the veterinary profession.

He thought the profession had badly failed in some ways. He went to the various veterinary colleges and found that in some of them the teaching of poultry husbandry given to the student was almost infinitesimal. He knew as he had to teach physiology and pathology to the people taking poultry husbandry that they acquired a good deal of knowledge which many veterinary surgeons did not possess. Could these shortcomings not now be made good? There was an opportunity, because the enormous value to the country of the poultry industry had become obvious to all. The profession really had a part to play. Nobody else could do it, specialisation was essential and some of the best brains in the poultry industry were present in the meeting. There must be a greater measure of efficiency in teaching and provision at the colleges for practical poultry husbandry, prevention of the basic poultry diseases, knowledge of handling, and so on. As an examiner, he had had experience of the extent of the knowledge of poultry diseases in some of the students that were qualifying and it was not sufficient. He supported wholeheartedly Dr. Gordon's remarks about the absolute essentiality of doing something more.

He felt that the meeting might like to put forward a resolution to the Royal College of Veterinary Surgeons instructing the teaching colleges that a veterinarian with experience of poultry husbandry and poultry diseases control be appointed to every veterinary teaching college and that facilities be provided for the practical teaching of both poultry husbandry and poultry disease control.

Dr. W. H. Bradley (Ministry of Health) wanted to extend what had been said from the point of view of human medicine. Practitioners of human medicine were almost as ignorant as veterinary practitioners with regard to the aetiology and origin of many of the diseases of man but one began to feel that perhaps this most important part of veterinary interest—poultry—had more to do with infections in man than might be suspected.

Recently a mistake was made when the Ministry of Health Regulation regarding the importation of parrots was rescinded and within a very few months one realised how until then psittacosis (or ornithosis), which was serious in man and in certain birds, had been prevented very effectively by relatively simple quarantine measures. It was almost as clear an indication of the value of quarantine applied at frontiers as the measures against rabies had been.

It would be remembered that during the war there were importations, in dried egg, of a large number of strains of salmonella capable of producing disease in man. Now there was a certain amount of control over this hazard because dried egg was no longer so important but there was still the risk from liquid preserved egg and it might be necessary at any time to go back to dried egg for use in the home. It would be of very great value, because of the difficulty of sterilising preserved egg, if more was known about salmonella in the flocks in this country in relation to disease in man.

Dr. Bradley concluded by saying that he had greatly enjoyed attending the Congress and listening to the discussions. He thought he was the only registered medical practitioner present. It was sometimes difficult to point to occasions when both professions should plan along common lines but he had no doubt whatever that in this field of disease in poultry there was great need for closer collaboration between human medicine and veterinary medicine.

Dr. W. R. Wooldridge, President of the Royal College of Veterinary Surgeons, congratulated Dr. Bradley on emphasising the intimacy which should exist between human and animal medicine and he would say that the veterinary profession looked forward to the day when the Ministry of Health had its own veterinary personnel as had health ministries in other countries.

On the question of knowledge of poultry diseases he must say at once that there had been a growing interest in the profession in the poultry industry. It had now reached a

position in the curve which to his mind made it possible to give that final drive which would really make that interest effective, allowing the profession to play its proper part. The veterinary profession had to change its point of view at almost every decade as the economy of the livestock industry changed. The time had come when the profession must play a far greater part in the economy of the poultry industry. It was up to them all to acknowledge, in realising that fact, that an enormous debt was owed to those few veterinarians who had specialised in different branches of knowledge and in that regard he thought tribute should be paid to Dr. Gordon who went into the Poultry Section of the Ministry at a time when, as one speaker had already implied, it was considered to be a backwater where one's future was never likely to be as brilliant as in other sections.

Dr. Gordon entered the poultry field, he realised that here was great scope for work, he continued in it, and had retained his enthusiasm for it. It was with difficulty that one could get Dr. Gordon to talk upon other aspects of veterinary knowledge and perhaps there was something to be learned from that; specialists were required to a much greater extent in the profession than had been thought. There were some who specialised in biochemistry, physiology, nutrition, and they had had a hard task to get the profession to realise as they did now that disease control and eradication was not a question of epidemiology alone, it was not a question of bacteriology or pathology alone, it was a question of applying knowledge in all these various branches of science and management.

Dr. Blount made great play with the errors into which the scientists could easily fall; only now after many years of nutritional research was it realised that there were different ways in which constituents of food could influence health. It was now known that nutritional disease could come about by the upsetting of the nutritional equilibrium in various ways. An excess of one factor could be given which was equal to deficiency of another due to the interplay of these factors. Great heed was rightly paid to lay specialists, but for full development the profession should have its own specialists so that it could more readily interpret results.

Finally he would like personally to say that he agreed with Dr. Gordon's plea for a greater emphasis on poultry in veterinary education. He did not agree with Dr. Blount when he said it should be a post-graduate course. He could think of no better way in which the educational system could be improved than to seize upon this opportunity which poultry gave them to enable them to provide to the student the living animal in numbers sufficient to study closely the principles underlying both health and disease. Poultry were still relatively cheap. Figures from South Africa demonstrated that students could be given 1,000 animals each, not per class or per school, but each, to examine in his course of training.

Another speaker had suggested that it was necessary to stimulate either the Royal College of Veterinary Surgeons or the Universities in this matter but he would like to pay a tribute to their representatives in the Universities, for they had been trying to push this development for the last few years in the schools. The Royal College too had emphasised these needs in talks with other bodies. Much more certainly had to be done, and where he thought the profession could play a much greater part was in showing that it was prepared to take a real interest in poultry. Changes were taking place. He went to the World Poultry Congress this year because he felt that the President of the R.C.V.S. should go. He thought he would see perhaps ten members of the profession there and he was delighted to see more than 50, quite a large number of whom played an active and much appreciated part in the Congress. He had also represented the profession on the Poultry Advisory Committee since its inception at the Ministry of Agriculture, and he would assure Dr. Barton Mann that the points he made on the effect of the control of disease in one area upon other areas, was fully examined. The majority of that Committee were active participants in the poultry industry and they were unanimous in agreement with the policy of the Ministry.

A change was also taking place in the poultry industry. At one time they said in a plaintive way that the veterinary profession had no interest whatever in poultry, while to-day they acknowledged the great help they received from those who had specialised in it like Dr. Gordon and many members of the Animal Health Division. The industry, he was certain, would be the first to appreciate any reasonably sound development in the profession with regard to poultry.

Dr. W. N. McKay (London) thought he might become a little unpopular by sounding what might be a rather disagreeable note so far as the profession was concerned in the control of disease in poultry. Dr. Wooldridge mentioned the 50 veterinary surgeons who were at the World Poultry Congress at Edinburgh, but he would like to ask if there was one practitioner there. The question of veterinarians specialising in the problems of the industry was to his mind a very difficult one. Nearly every one in the profession who had anything to do with poultry was in a subsidised position. Very few practitioners had very much to do with poultry disease. A realistic view had to be taken of this problem, there was very little doubt that the individual treatment of birds was not an economic proposition, that the treatment of disease on any scale at all in poultry would have to be through the water or feeding-stuff and whether the feeding-stuff industry liked it or not medicated foods were being forced upon them, and they did not welcome this. He was speaking not only as a veterinary surgeon but as one who was associated with a feeding-stuff firm; they had to supply food which included medicaments if the demand existed. The realistic view was that the individual treatment of birds by a veterinary practitioner was uneconomic.

The Chairman then asked if a member would care to second the resolution moved by Mr. Downham.

Professor Ottaway (Bristol) said that while he felt that Mr. Downham's suggestion was very useful and helpful it would be difficult to bind the Universities to a particular appointment. He would rather suggest that what Dr. Wooldridge said was very true. The University schools were now well aware of this need and were doing all they could in this direction, therefore no resolution of this nature was, in fact, necessary.

Dr. Wooldridge said he was not speaking against this resolution because he believed that stimulation and encouragement was often a great advantage but he thought it was framed in too rigid a form. It said "The Royal College should see to the appointment" of, and that was more than the Royal College could possibly do. The meeting would probably like to know that there was at the Royal College a special sub-committee which considered poultry and it was very much alive to this need in the Universities. Arrangements were now being made for the periodical visitation to the Universities from the Royal College. Advice was given on these occasions as to equipment and staffing and he could assure the members that this poultry requirement was one which the Royal College had in mind.

It was agreed that the resolution should not go further in view of the fact that the question was being looked into by the Universities and the Royal College.

THE REPLY

Dr. R. F. Gordon, in his reply to the discussion, said that it certainly had not been his intention or thought that his paper would stimulate a resolution to such an august body as the R.C.V.S. Nevertheless, he thanked Mr. Downham for ventilating the question and also the President of the Royal College for his favourable comments and for the interest which he had shown in the matter.

He also thanked both Dr. Blount and Mr. Reid for opening the discussion. Mr. Reid had given a valuable survey of the part which the Animal Health Division played in the control of poultry diseases.

Much as he would like to do so, time would not permit a detailed answer to the numerous questions which Dr. Blount had posed. Dr. Blount had criticised the incidence of poultry diseases which he (Dr. Gordon) had used, based on laying trial records, and commented on the low mortality which occurred at the B.O. & C.M. laying trials. That simply supported Dr. Gordon's own contention that disease was not unavoidable, and that where a veterinary surgeon had been in charge of the laying trials mortality rates were at the low level quoted by Dr. Blount! Dr. Blount also

drew attention to the fact that the financial loss did not stop with the dead bird, but that there was also a loss of potential profit. He fully agreed with Dr. Blount on this point and quite obviously the figures which he had quoted in the paper were a conservative estimate of the national loss, and in correspondence with the economists they had suggested that in assessing the loss due to deaths, one should consider not only the capital loss incurred by the death of the bird but also the loss represented by losses of opportunity for profit; and they suggested a sliding scale depending on at what point in the production period death had occurred. Dr. Blount, he thought, had rather suggested that the veterinary surgeon could be of little help in the majority of poultry diseases. He did not entirely agree with him on this point, for although the treatment of individual birds was uneconomic, he did indicate in his paper that the advent of specific therapy and prophylaxis by which flock treatment could be carried out had brought the veterinary surgeon far more into the picture as far as poultry diseases were concerned. Furthermore, he felt strongly that there was a place for veterinary advice at a flock level regarding vaccination and eradication programmes, blood testing régimes, hatchery hygiene and the like. Whatever some of the other speakers might feel as to the inevitability of medication being carried out in feeding-stuffs, he nevertheless regarded the use of such therapeutic substances as the province of the veterinary profession, and it was for the profession itself to decide on the mechanics of how this could best be carried out.

He was pleased that Dr. Blount had referred to nutritional diseases, particularly so-called "crazy chick disease," or nutritional encephalomalacia, and he strongly supported his view that we must be careful not to make categorical statements as to these conditions necessarily being associated with faulty rations. Research work had indicated, for example, in the case of perosis and its relationship to manganese deficiency, that this was a complex subject involving not only a mineral deficiency, but possibly deficiencies of components of the vitamin B complex, it was also influenced by genetical variability and even with husbandry factors such as the use of wire floors. Dr. Blount stated that he would prefer to see the education of the veterinarian treated as a post-graduate course, but he doubted whether the fruits to be obtained from specialising in poultry would justify an extended course. Furthermore, there was a proportion of recent graduates who joined the Veterinary State Services and poultry was becoming an increasingly important part of the work of the Animal Health Division. He still felt that poultry disease should be an integral part of the veterinary curriculum, although dealt with along the lines he had suggested in his introduction.

Reply to Mr. Reid and others

Mr. Reid had criticised the possible use of drugs in the eradication of B.W.D. He assured Mr. Reid that it was not his intention that any method of therapy should replace well established methods such as the rapid whole blood test; he did suggest, however, that the use of furazolidone, for example, could well be of value in supplementing the blood test and as an added insurance in dealing with flocks where difficulty had been experienced in clearing up infection. Its use in checking outbreaks, particularly in broiler plants, could be extremely valuable.

Mr. Reid had also commented on the value of formaldehyde fumigation in incubator hygiene, and he had had no intention of suggesting that this should be replaced in any way, for it was an extremely valuable tool in the control of egg-borne diseases. He did, however, draw attention to the two levels of formaldehyde fumigation defined in the Regulations of the Poultry Stock Improvement Plan; the lower level to be used as a routine measure and the higher when an outbreak of disease had occurred. In his experience the low level varied enormously in its efficiency depending on the equipment being used, the age, air-tightness, type and so on of the incubator, and in his experience even for routine fumigation the higher level should be recommended. They had no indication that the higher level had a detrimental effect on hatchability provided that it was carried out in the proper manner and at the proper times.

Mr. Reid also commented on the present position regarding the control of Newcastle disease. The only criticism he would level at the Animal Health Division was not concerned with their policy, with which he was in complete agreement, but rather their modesty in informing the industry of the satisfactory progress which they appeared to be making in the control of this disease. There had been a feeling in certain sections of the poultry industry that policy was being retained for policy's sake, and he felt it would be of considerable benefit both to the profession and to the Animal Health Division if the liaison between the Animal Health Division and the industry was at times a little closer.

There was insufficient time to reply to other individual speakers.

Dr. Bradley's comment was interesting, since the risk of *salmonella* food poisoning from the consumption of infected duck eggs was a problem that had exercised the waterfowl industry for some time, and undoubtedly was adversely affecting the economics of that industry. He drew attention to one possible line of approach to egg-borne *salmonellosis* and that was the use of germicidal egg dips. There was also the possibility that a drug such as furazolidone might be of value in eradicating infection in carriers since many such carriers were faecal excretors rather than by the reproductive tract.

He closed by saying that he was gratified to see such a large audience for a poultry paper, and thanked the audience for such a stimulating discussion.

The Chairman thanked Dr. Gordon for his paper and the openers for their contributions. The session closed with applause.

SUCCESSFUL APPEAL

The sentence recently passed by the Aylesbury magistrates on Messrs. Prophylaxis Ltd., of Glasgow, for selling cattle medicines under a misleading description was quashed by Buckingham Quarter Sessions Appeal Committee on November 31st. The prosecution was briefly reported in our issue of November 6th. The case was originally brought by the Buckinghamshire County Council, and the chairman of the Appeal Committee said, in the light of the defence that as the medicines complained of were homoeopathic and contained ingredients so diluted as to be undetectable by normal analysis, the Council had not proved their case.

CIRCUS GALA FOR THE ANIMAL HEALTH TRUST

A special gala performance of the Tom Arnold Harringay Circus will take place at Harringay Arena on December 22nd in the presence of H.R.H. the Princess Alexandra of Kent. The profits will be given to the Animal Health Trust. A similar gala last year raised over £6,000 for the Trust, and of this sum £1,200 was given by supporters to provide seats for orphaned children, old age pensioners and others.

To organise the social side of the gala a committee has been formed under the chairmanship of the Marchioness of Carisbrooke. Among the members is Miss Pat Smythe the celebrated horsewoman.

Members of the profession who may wish to take their children to the gala can purchase tickets through the usual agencies or the Harringay booking office. Donations for the provision of seats for orphaned children and others should be made direct to the Animal Health Trust, 14, Ashley Place, Westminster, S.W.1. The cost of each " guest " seat, with transport, is 8s.

SEVENTH CONGRESS PAPER

Fungoid Infections of Animals in Britain

BY

G. C. AINSWORTH

Department of Botany, University College, Exeter

The discussion on this paper took place during the morning of September 23rd, Mr. A. D. Osborne was in the chair, and the recording secretary was Mr. R. R. Willing.

IN opening the proceedings the **Chairman** said that, unlike certain of the other subjects dealt with at the Congress, they were about to speak of a subject on which it was difficult to mention very much about recent advances and treatment. One had only to go round a few farms, some quite well managed and well built, to find evidence of one of the most common mycological diseases of cattle in this country which has resisted all attempts at eradication. In recent years Dr. Ainsworth had done much to stimulate knowledge of the fundamentals of the subject of mycology, particularly as it applied to the veterinary field. It was, therefore, with great pleasure that he called upon Dr. Ainsworth to give a few facts and figures in amplification of his paper.

Dr. Ainsworth said that he considered it a very great privilege to be asked to address the Congress. It was very gratifying, but his satisfaction was not really personal. The week was a very notable one for British mycology. He believed he was the first mycologist to address a British Veterinary Congress, and that week the Ministry of Agriculture and Fisheries had made the appointment of a mycologist at the veterinary laboratory at Weybridge. That was a very big step and it was to be hoped that the future would show it was well justified.

Although he was interested in fungi, and during recent years had become particularly interested in some of those pathogenic for animals, he did not wish to over-emphasise their importance in the veterinary field. They would not, as far as one could see, ever have the importance that bacteria and viruses had to-day. But they did cause important, troublesome and, in some parts of the world, economically important diseases in animals, and their study had been neglected by both veterinary workers and mycologists.

The paper contained a short account that he was asked to write, and, if the Congress was like most others, members present would just be beginning to read it! The paper was aimed at pointing out something of the general background and dealing with generalities. He would not go over any of the points in detail, but wanted to bring the discussion to earth by showing a few slides which gave statistics of the material received for examination during the two years of the Survey which had just been completed, and by giving a picture of certain aspects of the position of mycoses in relation to animals in this country to-day as far as the rather small Survey revealed them.

One general point of importance was that most fungi did not cause disease in either animals or man. It was probably the same with bacteria as well. The impression one got was that more bacteria were pathogenic than non-pathogenic. That was in part due to the fact that some of the pathogenic bacteria caused major diseases, and comparatively few students had devoted themselves to a study of bacteria merely as bacteria. On the other hand, there had for 150 years been students of fungi and a great deal had been found out about fungi, especially in relation to the cause of disease in plants, and the few pathogenic for animals seemed to be of quite minor importance to professional mycologists. Animals and men were very often only incidentally infected by fungi. A point made in the paper was the well known fact that agricultural workers and those in similar occupations had a higher rate of mycotic infection. That was due to exposure to fungal spores, and presumably the same applied to animals.

Slides were then shown.

THE PAPER

The paper, which had been circulated in advance, was as follows :—

MOST of the fifty thousand accepted species of fungi are either parasites of, or saprophytes on, plants while some two thousand are parasites of insects and other small invertebrates. Only a few hundred are known to parasitise man and higher animals. Mycologists, being traditionally trained as botanists, have, therefore, tended to neglect the relatively few fungi pathogenic for higher animals. On the other hand, most of the major diseases of man and animals are caused by bacteria, viruses, and protozoa so that medical and veterinary men have also tended to neglect the rôle of fungi in the etiology of disease. Although fungi are unlikely to attain the importance of bacteria as pathogens of animals, just as bacteria are unlikely to attain the importance of fungi as pathogens of plants, it has become increasingly clear during the past 25 years that fungi are responsible for other, and even more important, diseases of man and animals than ringworm and throughout the world (particularly in the United States) increasing attention is being paid to this aspect of mycology.

It also seems to be coming increasingly probable that fungi are only incidentally pathogens of higher animals. That is, most of the fungi which are able to parasitise animals have a saprophytic phase which may be considered as the normal phase. Most mycoses are thus *exogenous*, the infection being contracted from some outside source, from some constituent of the environment favourable for the saprophytic growth of the pathogen. A few mycoses are *endogenous* when infection by a pathogen endemic in the community is contracted from an infected member of the community, and still fewer are *autogenous*, the condition in which the pathogen is found to be carried by many apparently normal individuals, that is, when the saprophytic phase occurs on the potential host. An autogenous mycosis, such as actinomycosis, tends to have a distribution co-extensive with that of the susceptible animal in contrast to the more local distribution of an exogenous disease. For example, coccidioidomycosis (*Coccidioides immitis*), an exogenous dust-borne disease, is limited to certain arid regions of North and South America while histoplasmosis (*Histoplasma capsulatum*) appears to be endemic in parts of the United States and in Central Africa where animals and man are, as for coccidioidomycosis, exposed to the same hazard of infection.

Another important development which has tended to draw attention to the potentialities of fungi as pathogens is the introduction of antibiotic therapy which by interfering with a normally balanced microflora has not infrequently resulted, particularly in man, in a mycotic infection more serious and more intractable than the infection against which the antibiotic was being employed.

In Britain, one mycosis of animals, epizootic lymphangitis (*H. farciminosum*), is subject to legal recognition. This disease of horses and other equines was introduced into England and Ireland by horses returning from the Boer War. A policy of slaughter resulted in the disease being eradicated within two years, and epizootic lymphangitis does not appear ever to have been reintroduced although the disease is endemic in countries surrounding the Mediterranean and other parts of the world. There were, however, subsequent major outbreaks in central Europe after the First World War and in India, Burma and Italy during and after the Second World War and these recent outbreaks afforded Bullen (1949-51) an opportunity of studying the disease and of making important contributions to its better understanding. Though rational, it is perhaps somewhat ironic that in a country where there is so little known about the significance, and even the incidence, of mycoses of animals that the one mycosis notifiable under an Order of the Diseases of Animals Acts should be an exotic disease.

In an attempt to obtain information on the occurrence and importance of mycoses of animals in this country the Agricultural Research Council recently sponsored a Survey of the fungi associated with disorders of farm animals. During 1952, the first year of this two-year Survey, most of the material subjected to mycological examination was collected by officers at the sixteen Veterinary Investigation Centres in England and Wales; during the second the co-operation of all veterinary practitioners was invited. As a result approximately 700 specimens were examined. A full report of the Survey will be published elsewhere and here attention is drawn to only a few of the more general conclusions to illustrate some of the more general aspects of mycotic infections in animals.

It should perhaps first be emphasised that the Survey was primarily mycological. It was designed as a census of fungi associated with disease in farm animals and to indicate some of the common components of the mycological 'flora' of these animals, although it was envisaged that the results might suggest topics meriting further and more detailed investigation. The Survey revealed no new major mycosis in the country. Neither, with one exception, was a major mycotic disease of animals in other parts of the world and hitherto unknown in Britain recorded. For example, histoplasmosis which appears to be of not infrequent occurrence in dogs in the United States is still unrecorded for any animal in this country where there have been a number of cases in man. The Survey did reveal the prevalence of several mycoses and also showed that many diverse moulds are frequently or less commonly found associated with animals.

It is, in passing, of interest to recall that agricultural workers frequently show a much higher incidence of a number of mycotic infections than do men in other occupations. Sporotrichosis (*Sporotrichum schencki*), rhinosporidiosis (a mycosis of warmer regions caused by *Rhinosporidium seeberi*), and coccidioidomycosis are all characteristically infections of outdoor workers in rural areas. This incidence is in line with the view that the source of these exogenous diseases is the soil or, for sporotrichosis, plants or plant debris. Why, according to a recent survey by Porter (1953), the incidence rate of actinomycosis (an autogenous disease) in Scotland is approximately ten times higher in agricultural workers than in non-agricultural workers is obscure. One thing that does seem clear is that farm animals like their owners are constantly being exposed to potentially pathogenic fungi.

Aspergillosis

The fungus most frequently isolated during the Survey was *Aspergillus fumigatus*, a common, easily identified, and ubiquitous mould of soil and compost. This nutritionally unspecialised and easily cultured mould is usually, and unequivocably, a saprophyte. At other times it is equally clearly a virulent and lethal pathogen. *A. fumigatus* is both the principal cause of aspergillosis in birds and, more rarely, in mammals and a not uncommon laboratory contaminant. It thus provides a good illustration of two important aspects of veterinary mycology, the problem of the pathogenic status of a fungus and the problem of the conditions which determine infection.

When a mycologist has identified a mould culture from an animal source submitted to him for "typing" as *A. fumigatus*, he is unable to pronounce on the pathogenic status of the organism and it is

only after consideration of the clinical and pathological findings of the case that a correct decision can be arrived at. That is to say, if the clinician or pathologist is not also a mycologist, and in these days of specialisation it is as difficult for a veterinary clinician to become a competent mycologist as for a mycologist to become an effective clinician, the workers in the two disciplines must collaborate. When this is done the mycologist may be able to supplement an identification with data on the distribution and ecology of the fungus which will assist in making a correct diagnosis of a particular case. For avian aspergillosis the pathological signs may be so evident that an experienced pathologist may, without making isolations, rightly guess the nature of the infection but even in such a straightforward disease as aspergillosis in poultry culture of the fungus does avoid all possibility of confusing the lesions with those of tuberculosis.

The epidemiology of aspergillosis is obscure. In poultry, aspergillosis is characteristically a fatal pulmonary infection of chicks (" brooder pneumonia ") which takes a not inconsiderable annual toll. Older birds are less frequently affected and among these wild birds, and particularly water birds such as penguins, are often victims during the early days of their captivity in zoological gardens. From this it would appear that young birds are more susceptible than older birds and that it is possibly loss of condition in captive wild birds that favours the development of the fungus. (It has been stated that aspergillosis is unknown among birds in the wild but there are now a number of reliable records of aspergillosis in free-living wild birds.) Although in zoological gardens hygienic conditions are usually satisfactory it seems clear that unhygienic conditions such as overcrowding and the use of mouldy litter are important factors determining outbreaks of aspergillosis on poultry farms and the fact that in Australia more poultry is kept "on range" may be the reason for the allegedly lower incidence of avian aspergillosis in Australia than in this country. There seems to be little evidence that increased virulence of the fungus is involved. There is little morphological variation between the large numbers of isolates from animals and other sources and all isolates seem to be equally pathogenic when injected into laboratory animals. No effective treatment for avian aspergillosis is known.

The epidemiology of aspergillosis is even more obscure in other animals in which the infection is usually also pulmonary but which may be primary in other organs. There is, for example, strong circumstantial evidence that *A. fumigatus* and other species of *Aspergillus* and also species of *Mucor* and allied fungi, are at times the primary cause of otherwise unexplained cases of abortion in cattle.

Avian Moniliasis

Avian moniliasis shows interesting epidemiological parallels to aspergillosis. In this condition there is usually involvement of the crop and the digestive tract and the causal fungus, the yeast-like *Candida albicans* which was first described as the cause of thrush in man, though of widespread occurrence is characteristically found in association with animals and is carried by large numbers of apparently normal individuals. Blaxland and Fincham (1950) described several large outbreaks of moniliasis in turkey poults which occurred in this country in 1949 but since then only minor outbreaks have been noted. As for aspergillosis, unhygienic conditions may play a part in determining epidemic outbreaks but the available evidence does not implicate these as major factors. During an epidemic, a 24-hour exposure of healthy birds to an infected flock may be sufficient for them to contract the disease but it is very difficult to induce an experimental epidemic even by feeding massive doses of the pathogen isolated from a natural epidemic (Blaxland & Markson, 1954). As for aspergillosis, there is little evidence that enhanced virulence of the fungus plays a part but vitamin deficiency of the susceptible birds has been suggested as a possible contributory factor.

Ringworm

Ringworm, which has been recognised in this country for more than a century, is still widespread among farm and domestic animals. The causal fungi, the so-called Dermatophytes, possess the ability to attack keratin and their activity as pathogens is limited to keratinised tissues. Although during the last year or two dermatophytes or dermatophyte-like fungi have been isolated from soil, most dermatophytes are known only in association with ringworm infections of animals and man and thus in contrast to *A. fumigatus* and *Candida albicans* the microscopic detection or the isolation in culture of a dermatophyte from morbid tissue is presumptive evidence that the fungus was present as a primary pathogen.

Although ringworm is such a familiar and well-established condition, there are surprisingly few satisfactory published records of ringworm fungi from animals in this country. This is largely because probably all the dermatophytes which infect animals are also able to infect man and because dermatologists, who have for long had a preoccupation with ringworm, have included a number of leading medical mycologists among their ranks. Also, since the war medical men have been able to call on the Mycological Reference Laboratory of the Public Health Laboratory Service for help in diagnosis. Other reasons are that minor infection caused by the cattle ringworm fungus (*Trichophyton verrucosum*) are more often ignored in cattle than in man, the greater ease with which that fungus can be isolated from man, and that the cat ringworm fungus (*Microsporum canis*) is more often overlooked on cats and dogs than on man.

It is still unfortunately necessary to emphasise that clinicians should whenever possible determine the species of ringworm fungus implicated in any case because in man there is ample evidence that different ringworm fungi call for different therapeutic measures and there is no reason to suppose that animal ringworm fungi differ in this respect.

In quite a significant number of the skin and hair samples submitted for examination during the Survey and taken from cases diagnosed clinically as

ringworm no evidence of dermatophyte infection could be found. This may in part be due to the confusion of other conditions with ringworm, it is almost certainly in part due to the difficulty that may be experienced in detecting *Microsporum*-infected hairs in cats and dogs without making an examination of the animal under Wood's light when the infected hairs show a characteristic greenish fluorescence so that even a small number of infected hairs on an animal can be detected. A Wood's lamp should be considered an essential item in the equipment of every small animal practitioner.

It appears that for cats nutrition has an important influence on the clinical picture, an under-nourished animal showing more severe symptoms than a well-fed animal, but it seems unlikely that improved nutrition ever in itself results in the elimination of an infection. In man, the human *Microsporum* (*M. audouini*) most frequently attacks children in which infections tend to be eliminated spontaneously at puberty. Young animals also appear to be more easily, or at least more frequently and more severely, infected than adults but the relation of the infection to age of the animal has not been elucidated.

Trichophyton infections are not revealed by Wood's light examination, but in cats and dogs such infections seem to be less frequent than those caused by *Microsporum*, and, especially in cattle, the lesions tend to be more inflammatory and so more easily located.

Among other dermatophytoses recorded during the Survey was a minor epidemic of ***Trichophyton equinum*** ringworm in horses in a group of riding stables but fowl favus (*T. gallinae*) which was apparently common in this country early this century is now of very rare occurrence.

Mastitis

In conclusion attention may be drawn to the involvement of fungi in certain cases of bovine mastitis. During the Survey more than sixty cases of mastitis associated with fungi were noted and in a number of these there was a history of penicillin treatment. This finding is in line with the now so frequent reports in man of mycotic side effects following antibiotic therapy. In man, ***Candida albicans*** is the fungus most frequently implicated (*e.g.*, oral moniliasis following the use of penicillin lozenges). In the mastitis cases no one fungus predominated—both moulds such as species of *Aspergillus, Absidia,* and *Mucor* and a number of yeasts having been identified. The most likely general explanation of these infections in man is not that the antibiotic has encouraged the growth or enhanced the virulence of a fungus pathogen already present but that by eliminating bacterial competitors the fungus has been able to develop. This may be the usual explanation also for mycotic mastitis but there have been reports from other countries that failure to take adequate aseptic precautions has resulted in the fungus being introduced into the animal with the antibiotic and it is possible that such an effect has occurred in this country also.

Summary

An attempt is made to indicate, against a wide ecological background, certain general characteristics of fungoid diseases of animals with special reference to the mycoses of animals which occur in Britain. Difficulties in assessing the pathogenic status or fungi found associated with pathological conditions in animals are indicated by a consideration of aspergillosis and moniliasis and attention is drawn to effects of the host on pathogenicity. Mycotic side effects resulting from the elimination of components of the normal microflora of animals by the administration of antibiotics are also touched on.

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THE OPENER'S SPEECH

The Chairman said that to open the discussion they had one who had been interested in fungal diseases of animals for a very considerable period. He was pleased to call upon Mr. Watkins to address them.

Mr. C. V. Watkins said: I must first congratulate Dr. Ainsworth on his very able introduction of these fungoid infections of animals to a British veterinary congress.

Personally I am greatly indebted to him for much assistance before he started his Survey work. From the numerous occasions on which we have encountered these disease agents in *post-mortem* specimens in this south-western province I conclude it must be a very mouldy area. For the same reason I would like to express my best thanks to other mycologists, including Dr. Duncan of the London School of Hygiene and Tropical Medicine and various members of the staff of the Commonwealth Bureau of Mycology for typing cultures and critical comments.

Respiratory disorders have chiefly been set up by these agents and *Aspergillus fumigatus* has proved to be the most common pathogen. However, very mixed infections have often been determined.

Regarding brooder pneumonia of chicks I am convinced there are peracute initial changes which can go unproven without cultural tests, and in this respect congested and/or oedematous lungs may be regarded as part of the chill complex. For example, for a period one hatchery sent out batches of chicks, almost all of which died, some in transit, from such lung disease. The infection was in the mammoth incubator.

Last season mouldy hay and wood fibre in chick despatch boxes was similarly implicated. In a period of two years before the war we found 10 per cent. of congested chicks' lungs yielded mould cultures. The comparative figure for those with typical nodular lesions was less.

I could say quite a lot about turkeys, but will merely add they seem even more susceptible than the common fowl.

Deep litter, if mouldy, is a serious hazard. I record one outbreak in which birds were placed in such litter in the morning and were dying by midday, virtually from drowning, their lungs being very oedematous. I have records of similar losses in sheep, one outbreak in Cornwall being due to feeding mouldy roots in a dry period. On *post-mortem* the lungs were very congested but all the major air passages were lined with green sporulation (Aspergillus spp.). An open-sided shed in the same field in which I made the *post-mortem* contained the most mouldy roots I have ever seen.

In the last progress report of his Survey Dr. Ainsworth refers to pneumonias in pigs due to these agents, calling for more intensive investigation of this form of disease. He kindly typed such a mixed infection for me the other week. The areas of patch pneumonia, some appearing to

be necrotic, showed bundles of mould mycelia on direct smear examination.

In one outbreak of brooder pneumonia of chicks a mucor sp. of mould only was isolated and confirmed by Dr. Ainsworth's assistant, Mr. Austwick.

Yeast Infections

I will merely mention crop mucosis as a regular finding in turkeys and common fowls. Of interest otherwise I record crop mycosis in a pigeon, moniliasis of air sacs in two grey African parrots (one a replacement from same vendor at £20 each), and a similar disease in a bantam, all probably due to *Candida albicans*.

One mould we isolated from fowls with severe respiratory and intestinal catarrh deserves special mention, namely *Mucor pusillus*. Dr. Ainsworth informed us that it is a known human pathogen and further that it only grows in culture at from 35° to 37° C. He will perhaps pinpoint it into his classification for our further information.

Among the many faeces examinations we do, many yield a similar picture of massive mould content. In one very widespread outbreak of scour in a dairy herd such a finding led immediately to the cause of the trouble.

We have found scour of piglets with necrotic enteritis and in which Geotrichum spp. seem to have been implicated. Dr. Ainsworth informed me these are recorded as associated with intestinal upsets in human disease. The classic example seems to be that reported by Mr. Wilson, of Ayr, in which several piglets died after eating mouldy bran. Twelve species of fungi were present and each may have been toxic.

We had two notable outbreaks in cattle last year.

In the one five abortions occurred during August and September from grazing a quarter acre of hand sewn ley pasture through a partial failure of growth. This allowed the late flowering of the grasses in this one small area of the field.

The other cases were of severe diarrhoea in a pedigree Jersey herd at the end of August onwards. Several were also affected with dysentery and one died.

They were grazing a mixed ley and dredge corn pasture, which was heavily ergotised.

All grasses flowering from July onwards in this country have been recorded as ergotised. I have taken the liberty of illustrating the variety of infestation by a small selection of such grasses as the specimens I have mounted.

Abortions in Cattle

If culture of moulds and yeasts is obtained from aborted foetuses from their alimentary tract as for other abortion causing agents, also in some cases lesions of the foetal membranes and skin being present I conclude they are very possibly the cause of the abortion, in the absence of other evidence.

One striking series of such cases owed its origin to the damp condition of the byre and pervious walls growing every kind of mould. When ventilation was corrected and the walls cement-lined such losses ceased.

Ergot

This is undoubtedly a very serious problem in this area. In my opinion it probably accounts for many outbreaks of scour in grazing animals from the end of July onwards, provided they have access to pastures allowed to flower and seed. With our extraordinary seasons, late cuts of hay in these parts can also be dangerous to stalled animals. We have confirmed this opinion.

Mastitis

I agree entirely, from the history of so many cases, that pre-treatment is usual, and Dr. Ainsworth's reasoning as to the causation being either through an upset of a normal balance within the udder by the antibiotic used or, more likely, that such findings as moulds and yeasts may be a warning as to the technique of injection needed to avoid these cases.

Mixed agents have frequently been isolated and typed by Mr. Austwick, and one case yielded two Aspergillus spp., two Mucoraceae spp. and a yeast.

Favus in mice, a truly horrible disease which erodes through all underlying tissues, has been determined this year. Incidentally, the colony of mice were running round a chemist shop of all places.

Smut of wheat, *Tilletia caries*, caused a severe diarrhoea and fall in egg yield in a laying flock three years ago. Recovery followed when the food was withheld.

THE GENERAL DISCUSSION

Mr. W. A. Pool (Commonwealth Bureau of Animal Health) said that he wanted to pass on congratulations. He congratulated the Congress Committee for staging this discussion in the way they had, and for giving Dr. Ainsworth and his team the chance to tell them what had been revealed in the paper. Dr. Ainsworth was also to be congratulated for the way in which he had developed the recent interest in fungous disease of animals and man. He is a very distinguished mycologist indeed. Mr. Austwick was to be congratulated on his appointment to the staff of the Weybridge Laboratory—they looked forward to developments by him—and so was Mr. Watkins for the way he had taken advantage of being near Exeter and, as the local Veterinary Investigation Officer, of doing his part nobly.

With regard to fungous diseases of animals the operative word seemed to be "neglect." Mr. Pool thought the profession did not know very much more about them than when he was a student. It had lived on clinical observation on this subject and this approach had not produced results. The clinical observation is all important, but its limitations must be recognised. Without clinical observation pure laboratory work would often be unproductive. Fungous diseases, however, provide many examples of the limitations unless clinical observation was suitably supported by microbiological research of the right type.

There was now a new interest in mycology and that was almost entirely due to Dr. Ainsworth. He had been campaigning now for many years on two sides—one being the taxonomy of fungi—and developing knowledge of the capacity of these micro-organisms to produce disease in animals and man. If Dr. Ainsworth had not done what he had in recent years the movement to develop the subject—and it was a strong movement—would not have gone so far. His very able leadership was required.

It would be very nice to see a young veterinarian trained in mycology, and the training would have to be a very special one. Training in bacteriology did not get one anywhere in the field of mycology. As often as not it misled. The right man, with a thorough training in mycology, built on to his veterinary training, would be able to produce results steadily as the years went on, perhaps better results ultimately than would be obtained by attention to the clinical side with a dependence on the pure mycologists for collaboration. There was, however, a danger in a profession such as the veterinary profession that if a man specialised in a small subject he would find himself in a blind alley. This point should be given close attention by those who control research.

Dr. Ainsworth and Mr. Austwick had carried out a most important survey on fungous disease of animals in Britain during recent years and this had shown that a tremendous lot of further investigation was needed.

It could not be said that, all round, fungous diseases were the cause of such extensive financial loss that investigation of the subject would be likely to produce large spectacular results measurable in terms of money. Losses due to such diseases were often extensive, often important, and sometimes a financial burden. Gains to be obtained by the further development of this subject would be direct in that they would provide practical measures in the control of certain diseases. A very important result of such investigations would undoubtedly be the provision of knowledge that was of more academic than practical value, and that would provide its quota for the solution of problems not necessarily directly related to the subject.

The extent to which ringworm is a public health problem related to domestic animals is not always sufficiently realised. The profession has been criticised for failure to

control ringworm in domestic animals. Results of recent observations have indicated that ringworm may be present and a danger without any obvious clinical manifestation in the animal that serves as a carrier.

Dr. F. I. Awad (Egypt) congratulated Dr. Ainsworth and said that he had been working for the last two years at the London School of Hygiene and Tropical Medicine on sarcosporidiosis in sheep and toxoplasmosis in man and animal which has led to controversy in the United States and this country. In Newsom's *Sheep Diseases* (1952) there was a chapter entitled fungoid diseases, and the first disease to be mentioned was that of sarcosporidiosis. Spindler *et al.* (1945) assigned *Sarcocystis* to the genus Aspergillus. It would be most interesting to hear Dr. Ainsworth's opinion about such a disease. He had examined a large number of sheep from Kent, Devonshire, Yorkshire and Somerset and by far the greatest number of sheep infected came from Kent or Devonshire. The importance of deciding the systematic position of *Sarcocystis* was fundamental.

It was surprising to find that not many veterinary surgeons were familiar with this disease, but why should that be? It is widespread. In Devonshire about 60 per cent. of sheep were found to be infected. In Dr. Awad's opinion the reason for this was that the muscular system in man and animal was not subjected to that scrutiny which the viscera undergo in pathological enquiries; sarcocysts may be present and yet not be diagnosed.

Was this disease of economic importance? He said that he could only answer from his own limited experience that sarcosporidiosis is of economic importance and hence it is necessary to draw the attention of the veterinary profession to this muscle disease.

Miss O. Uvarov (Cobham) thanked Dr. Ainsworth for the very excellent and important paper he had presented. Perhaps they had never realised the importance of the subject, and as clinicians they had certainly neglected it to quite a considerable extent. She wondered if they were quite as guilty as was thought, particularly in relation to their medical colleagues, who frequently showed no enthusiasm for co-operation with our profession on the matter, and tended to blame pet animals as a positive source of infection for humans. The result was that destruction, particularly of cats, was frequently requested, on the grounds that these were the alleged carriers of the infection.

They were not fortunate in having a lot of statistics on the incidence of animal ringworm, so the figures Dr. Ainsworth had given were very illuminating. Recently a report was published in the *Journal of Hygiene* (June, 1954) on an eight-year survey of ringworm in the Birmingham area. Out of something like 657 cases examined, 508 were due to *Microsporum canis*, so the reservoir of infection from the animal was quite extensive. Now that a mycologist had been appointed at Weybridge, perhaps in time the incidence of fungoid diseases in animals would be known.

Many years ago Miss Uvarov had seen two cases of what she thought was ringworm in the dog, and on making an examination it proved a mange of equine origin, though the lesion was entirely typical of a canine ringworm. The two dogs had been roaming over the downs where there were said to be a number of gipsy horses. Once the right diagnosis was ascertained the condition cleared up quite quickly.

Would Dr. Ainsworth say if he had encountered *Candida albicans* infection in animals—particularly cattle? Miss Uvarov had not been able to find any reports as to the possibilities or if it existed as a primary infection—particularly in infertility.

When children were apparently infected with ringworm from dogs, was it true that the infection went from child to child until it died out after three of four transmissions? Also, had anyone present tried treatment of ringworm by spraying rather than by a local application? Were they perhaps slightly at fault when dealing with ringworm in treating the only actual lesions, and not investigating the possibility of some mineral imbalance or deficiency of iodine.

The Chairman said he was most interested to note that the incidence of ringworm in cattle was equal throughout the year. It had always been his impression, from what he was taught at college and experience after, that ringworm was mainly a disease of the house animal and that it was mainly seen during the winter months and generally tended to clear up during the summer months when animals were exposed to sunshine. That view was shaken when he saw ringworm in a number of yearling animals which had for some time been roaming over the Wiltshire downs in September and exposed to sunshine. Could Dr. Ainsworth give them any information on the actual effect of sunlight on the ringworm fungus, and could he say if it was such a great killing agent as was at one time supposed? Also, could any information be given as to the likely significance and presence of the disease known as mycotic dermatitis? That had been reported in Australia, and the Chairman said he had seen a few cases, but was unable to confirm them mycologically in this country.

THE REPLY

Dr. Ainsworth, in reply, said he was afraid he did not know anything about the disease mentioned by Dr. Awad. It was important that the status of the organism should be settled. On the point about *Candida albicans* causing a primary infection in animals, it was a primary pathogen in moniliasis in poultry and there were occasions when it seemed to have a similar status in the digestive tract canal of mammals. There were two cases of such an infection encountered during the Survey, one in a dog and one in a cow. In the dog infection followed the administration of antibiotics and appeared to be a similar case to those now so common in human medicine in which a fungus came into prominence when an antibiotic had eliminated all its competitors in a particular site. The status of *Candida albicans* was often very difficult to assess, it was apparently carried by so many normal individuals and the reasons why it became pathogenic were very obscure. The greatest hope for the problem being solved was by an approach from the animal side by veterinarians. It was far easier to get 1,000 chicks together for an experiment than 1,000 men.

It was believed the passage of an animal ringworm fungus from man to man was limited and re-infection from a cat or dog was necessary. Although minor epidemics in schools did occur due to infection by *Microsporum canis*, they were never so serious as when caused by *M. audouini*.

Dr. Ainsworth felt he was having an easy time in answering the points raised in discussion because again on the next question, that concerning sunlight, he knew nothing. Moulds were often sensitive to sunlight and in a laboratory steps were always taken to keep cultures away from direct sunlight, but he thought that the effect of sunlight on a disease such as cattle ringworm was possibly not on the fungus but via the animal. Sunshine increased the vitamins and the improved state of the animal would suppress the ringworm symptoms.

Mycotic dermatitis, so-called lumpy wool, was known to Dr. Ainsworth. Samples of it had reached him from Australia, South Africa, and New Zealand. The organism was a difficult and delicate one to deal with in the laboratory, and it was not known whether the disease really occurred in this country. A similar condition seemed to occur here but the organism had not been isolated from British material as it undoubtedly had been isolated from South American and South African and Australian material.

Finally, Dr. Ainsworth thought he must correct the impression Mr. Pool might have given the meeting. Very little credit for any of this work was due to him. The increased interest in veterinary mycology was a sign of the times, and a major factor in this interest in fungi was penicillin. During the war penicillin made more people conscious of fungi than ever before and a widespread use of penicillin and other antibiotics had proved a great stimulus for the study and consideration of fungi. It was very disconcerting when after the administration of first-rate antibiotics a patient died due to the activities

(Concluded on p. 856, col. 2)

EIGHTH CONGRESS PAPER

Summary of the Known Functions of the Adrenal Gland

BY
J. L. McGIRR
Weybridge

This paper was discussed at the Torquay Congress on September 23rd. Professor C. W. Ottaway, PH.D., F.R.C.V.S., was in the chair, and the recording secretary was Mr. J. Brown.

The Chairman, opening the session, said he thought it was very appropriate that the subject of functions of the adrenal gland was chosen for discussion at the Congress, for in these days one rarely picked up a scientific journal of any denomination without finding in it some reference to adreno-cortical activity, whether the term was associated with stress or any other factors. As a pre-clinical teacher, it was very pleasing to him that the emphasis in the paper was on the word "function," for it would be agreed, as was suggested by the author, that without an appreciation of normal functions, excursions into the field of the clinically deranged were limited. It would no doubt be agreed that when features of potential value to the clinician were being considered they should explore that which might be learnt from many subjects. It was, therefore, very satisfying to them that an exponent of that all-important but hitherto much neglected science of biochemistry was chosen to introduce their deliberations on this modern topic. It was a great pleasure to call upon Mr. McGirr to introduce his paper.

Mr. J. L. McGirr said that he first wished to express very sincere thanks to the Committee of the B.V.A. for asking him to address the Congress, and he would, on behalf of all biochemists, thank the Chairman for his opening remarks. The Chairman had just stressed the question of normal function. Unfortunately, in this field particularly, the question of normal function was very important, and, unfortunately again, it was very little understood. There had been many publications, literally tens of thousands, in the last six or seven years on the functions and effects of pituitary adrenal relationships, but the majority were derived from experimental work and clinical work on laboratory animals and on man, and so far as he was concerned a great deal of his interest in the subject related to the ruminant. It was very unfortunate that their knowledge of ruminant physiology in so far as this subject was concerned was very sketchy indeed and for many purposes practically non-existent.

Mr. McGirr said he would give an instance of this, and here he was going to stick his neck out a little bit. Recently he and his colleagues had been examining relatively large numbers of adrenal glands from cattle, the majority being supposedly normal animals, and he had not succeeded in getting anyone to tell him how many of those adrenals were normal and how many were not. One got a gland from a normal animal and found the cortex was large and haemorrhagic in parts, yet the animal seemed to get along quite happily. At just what stage one said a gland was definitely abnormal no one seemed to be prepared to state—a gland, that was, from a bovine animal.

The Problem With Cattle

The next point concerned the examination of the live animal to detect pituitary adrenal upsets. The biochemist was dependent on methods which were derived mainly from work on human blood and urine and similar materials from dogs and smaller laboratory animals. At Weybridge an attempt was made to apply some of those methods to material from cattle and sheep, but the efforts met with singularly little success. There had been a number of publications dealing with the excretion of material in the bovine urine related to adrenal hormones.

Unfortunately, the characterisation of steroids in bovine urine was a much more difficult task than it was in material from a non-ruminant. At Weybridge they were not at all satisfied that the substances detected were necessarily of adrenal origin. A recent private note from a colleague in Holland suggested that some of the materials classified as neutral steroid were probably not steroid at all. Only a rough check had been made so far, but it did seem that one must regard with a certain degree of suspicion information which was published on analyses of bovine urine carried out by orthodox methods which had derived from work in man. The bovine, of course, did do peculiar things to steroid hormones in general.

In most animals one could detect 10 per cent. of injected steroid material. In the ruminant that was not so. What happened they did not know, but it was extremely difficult to detect substances in bovine urine following the injection of steroid hormones of one sort and another.

In relation to the stresses and strains of life in general, there had been one or two interesting figures given recently of adrenal weights for certain species of wild animal compared with weights for

domestic livestock. In particular this related to rats, and it was interesting to know that the wild rat had an adrenal gland three or four times the size of that which occurred in the vast majority of domesticated laboratory rates. The implication perhaps was that animals in wild conditions had to deal with many adverse environmental circumstances and made full use of their adrenals. As a result of modern farming methods livestock were shielded to a great extent from many of the strains to which the wild animal was subjected and consequently they had not got such useful adrenal glands when emergencies arose. This might be one of the reasons why pituitary adrenal dysfunctions were coming so much to the forefront.

Treatment

Mr. McGirr said he would not go over the actual points in the paper but wanted to make a few remarks about treatment in general and therapeutic possibilities of adrenal and pituitary products. Quite a considerable amount of work had been done on this subject at Weybridge from the therapeutic angle and a considerable amount of information had been collected from blood samples and other samples sent in by practitioners, and to all those whose materials he was using at the moment Mr. McGirr conveyed his very sincere thanks. So far as acetonaemia was concerned a summary of the data available made very disappointing reading.

For ACTH of different types, with quite considerable variations in dosage levels and in the times of dosage, the results were very poor. Material had been summarised relating to a considerable number of cases, and the recovery rates were in the region of just over 50 per cent. That was a treatment efficiency which could be obtained with practically any form of therapy. One did not seem to be able to do any better so far with any of the treatments which were available. One or two appeared to be rather better than others, but when a fairly large number of animals was dealt with the level was nearly always the same.

It might be wondered what the recovery rate was in animals which were untreated. He had suspicions that the rate would fall very near to the same 50 per cent level.

The results of ACTH and cortisone therapy in sheep were disappointing also. There was something less than a 30 per cent. response in pregnancy luxaemia.

Nevertheless, he felt that work with hormonal preparations of this sort from the laboratory point of view at any rate, was important, as they were undoubtedly concerned with metabolic disorders and probably had quite a part to play in problems related to resistance to infectious disease in general. Mr. McGirr said he wanted to enter a plea for rather more veterinary work in the whole field of endocrinology. To-day they were very dependent on material results and experimental data derived from medical schools, physiology schools and others. They knew cattle were very different from the non-ruminant, just as different in their handling of these hormone preparations as they were in their digestive system, and it seemed that efforts made in this field would be well repaid.

THE PAPER

The paper, which had been circulated in advance, was as follows :—

ON September 21st, 1948, at Rochester, Minnesota, U.S.A., 100 mg. of one of the hormones of the adrenal cortex designated " Compound E " (later to be known as cortisone) was injected into a patient suffering from rheumatoid arthritis. Within a few days this patient, who had been becoming progressively more disabled for five years, walked out of hospital with all pain and stiffness gone. Thus was initiated the present period of intensive clinical trial and research on the adrenal and adrenocorticotropic hormones. Unfortunately, knowledge of the physiology and pharmacology of the substances used has not kept pace with the enthusiasm of the clinicians and it seems that, notwithstanding the enormous effort being directed to evaluating the nature and uses of these substances, some considerable time must elapse before they find their due place, if indeed they have a place, in the armoury of those whose duty it is to combat disease.

Some two years ago a *British Medical Journal* editorial summed up the position at that time in the statement that " it is still difficult to be certain whether cortisone (and we might add ACTH) is going to be more important as a therapeutic weapon, as a research tool, or as the stimulus to new exploration in the search for vital information about the nature of disease." The findings of the past two years only add emphasis to this statement and, indeed, suggest that the impetus given to fundamental research on the nature of disease may be the most important result of the discovery of the therapeutic and pharmacological action of these highly active substances. On the other hand, their usefulness in disease therapy may run the gamut of all the phases through which so many forms of treatment go and which were so well described more than 30 years ago by Ringer ; a period of delirium being followed by one of execration, and that by an era of apathy which sooner or later is succeeded by a time when critical evaluation and laboratory and clinical appraisal lead to a valid assessment of the field of usefulness of the substance or treatment in question.

The veterinary applications of much of the new knowledge which is being amassed must remain for the future to decide, but the implications of some of it are obviously considerable. The following brief summary is an attempt to indicate my view of the present position; it merely outlines some aspects of modern ideas of adreno-cortical physiology, which may require very considerable modification and alteration in the light of future research.

The train of events set in motion by the response of the adrenal medulla to emotional excitation and to a wide variety of external or internal stimuli and noxious agents has been well known for many years. The cortex of the adrenal was thought to be much more phlegmatic and to be concerned with, and restricted to, an entirely different set of phenomena—namely, the maintenance of a constant internal environment for the

cells. In other words, the medulla initiated physiological change whereas the cortex seemed to preserve the *status quo*. Only recently has it been realised that the cortex is much more than a stabiliser and that it is fully as important as the medulla in enabling the organism to adjust itself effectively and efficiently to the major and minor vicissitudes of existence.

When a normal animal is subjected to stress such as exercise, cold, trauma, toxins, infections, etc., there is evidence of considerable adreno-cortical activity. The level of blood lymphocytes and eosinophils is depressed, general atrophy of lymphoid tissue occurs, the ascorbic acid content of the adrenal glands falls sharply, the fat-staining material of the cortex is reduced, urinary nitrogen output rises, blood glucose levels may or may not alter, and urinary output of corticoid material increases. The precise relationship of some of these changes to increased cortical hormone output remains obscure, but taken together they afford good evidence of increased gland activity. After adrenalectomy, a variety of metabolic effects become evident. At first, if operative shock has been avoided, the animal remains relatively normal but, later, a decline sets in, and death occurs in most species within 5 to 20 days. The symptoms before death include loss of appetite, nausea, diarrhoea, asthenia, a variable degree of hypoglycaemia, fall in blood pressure and renal failure. There is excessive secretion of sodium and chloride by the kidney, and diminished clearance of potassium, and clear evidence of deranged metabolism of carbohydrate and protein.

Whatever the broad function, or functions, of the adrenal cortex may be, and it should always be remembered that, in contrast to the medulla, it is essential for life, it attains its end by releasing into the blood stream a variety of hormonal compounds which either are, or become, with relatively simple manipulation, crystalline steroids. Twenty-eight such compounds have been isolated from adrenal glands—all have a fundamental ring structure which appears not only in these corticoids but also in substances such as cholesterol, the testicular and ovarian hormones, and the digitalis group of drugs. Neglecting completely any chemical classification the corticoid hormones can be grouped roughly according to their biological properties, if allowance is made for the fact that there is a certain overlap with some compounds exerting effects in different categories.

In the first instance, there is a group of adrenal hormones which includes androgens, oestrogens and progestational steroids. The functions of the latter groups are obscure ; the androgens, on the other hand, seem to be involved in the sex changes which occur at puberty and, in man and laboratory animals, they are responsible for the total urinary 17-ketosteroid excretion in females and for some two-thirds of it in males. (Some of the 17-ketosteroids in males are of testicular origin.) It is important to note the origin of urinary 17-ketosteroids since, in some instances, their excretion has been used as an index of adreno-cortical metabolism without stressing the fact that the hormones and hormone effects under investigation were distinct from those producing the 17-ketosteroids. It might be as well to note at this point that there are indications that the ruminant differs markedly from man and the smaller laboratory animals in its metabolism and excretion of these substances and that not all of the material which records as 17-ketosteroid in analyses of ruminant urine by standard human methods is indeed steroid in character.

The next important group of adrenal steroids are the so-called " mineralo-corticoids," *i.e.*, those hormones which have pronounced effects on the metabolism of sodium, potassium and water. They correct the disturbances in electrolyte metabolism that occur in adrenalectomised animals and in cases of cortical hypofunction. A familiar example is desoxycorticosterone ; this hormone can be made synthetically and is readily available, though it occurs in very minute quantities in the adrenal gland itself. Within the last two years a highly active hormone of this type provisionally named " Electrocortin " has been isolated from animal and human material. In the absence of mineralo-corticoids, and in the presence of normal posterior pituitary activity, the kidney tubules are incapable of reabsorbing sufficient sodium and chloride to maintain a normal balance of electrolytes. The sodium and chloride loss leads to a large reduction in extracellular fluid volume resulting in haemo-concentration and reduced plasma volume. The potassium level in serum increases. The whole syndrome can be reversed by supplying adequate amounts of " mineralocorticoids." On the other hand, while adrenalectomised animals can be kept alive by supplying these substances, they are very susceptible to stresses of any sort.

The next group of compounds plays a major rôle in many of the adaptive responses to damage or stress. This group, containing the so-called " glucocorticoids," has attained prominence in the last year or two ; it includes Compound E (cortisone) and Compound F. These hormones play a vital part in the metabolism of carbohydrate, fat and protein, have marked effects on lymphoid tissue, blood lymphocytes and eosinophils, alter fibrous tissue responses to wounds and infection, and modify hypersensitivity reactions of bacterial and non-bacterial types.

Much of the recent work on pituitary adrenocorticotropic hormone (ACTH) is related to the effects produced by various cortisone or cortisone-like compounds released by the adrenal cortex. It must be noted, however, that different preparations of ACTH may vary in their composition and effects, and workers using material prepared in different ways have not always achieved the same results.

In experimental animals, and in man, cortisone and ACTH profoundly affect carbohydrate metabolism by inducing gluconeogenesis from protein sources. The consequence is a marked increase in the supply of available carbohydrate, an increase in urinary nitrogen excretion and an alteration in fat metabolism. Atrophy of lymphoid tissue associated with lymphopenia and eosinopenia is another remarkable attribute of these hormones. They have been used therapeutically in the treatment of lymphoid neoplasms. In general, the immediate response is favourable, but the growths recur as soon as treatment is discontinued. Inflammation of certain tissues of mesenchymal origin, *e.g.*, connective tissue, synovia, vascular tissue and muscle, is strikingly modified by exogenous hormones of this type with corresponding improvement in the clinical manifestations of the disease in question. Unfortunately, in

most cases symptoms return as soon as treatment is stopped. Because of their effects in inhibiting fibrous tissue formation, ACTH and corticoids exacerbate many experimental and natural infections and, while in others they produce prompt remission of symptoms, infection is not removed. There are many indications that cutaneous sensitivity to tuberculin is depressed by these hormones and work at Stormont indicates that, in cattle, non-bacterial sensitivity may also be reduced. In general, it seems that many forms of allergic sensitivity respond favourably to these substances.

There is, of course, much evidence that the action of adrenal steroids is affected by the levels of a number of other hormones, notably thyroxine, the oestrogens, and the gonadotropins as well as by ACTH itself, and the pituitary growth hormone. For example, the administration of cortisone depresses adrenal function by reducing the output of pituitary trophic hormone, and the blood level of oestrogens has an effect on the release of ACTH by the anterior pituitary and thus on gluconeogenesis with an increase in blood sugar ; in experimental animals thyroxine and cortisone have antagonistic actions on hypersensitivity reactions.

One of the major difficulties of biochemical studies in this field is that the bulk of injected or adrenal-released steroids is structurally destroyed—much less than 10 per cent. can be recovered in a form related to the injected material. In the normal sheep there is evidence to suggest that the adrenal glands are producing several hundred milligrammes of cortical steroids per day—only 20 mg. of corticoid material can be recovered from urine. Further, work carried out at Weybridge suggests that the ruminant differs markedly from man and the smaller laboratory animals in its metabolism and excretion of these substances ; in fact, it is by no means certain that much of the material which records in the standard analytical methods for human urine is indeed of cortical origin.

The only diseases of veterinary consequence in which these substances have been used therapeutically on any considerable scale are acetonaemia of cattle and pregnancy toxaemia of sheep. There have been a considerable number of American publications over the past few years which seemed to suggest that cortisone and ACTH were very useful adjuncts to the drugs available for the treatment of acetonaemia. Unfortunately, results in this country have been much less satisfactory. ACTH preparations of bovine and porcine origin, and cortisone, have been used and, in general, have given a level of success in some 50 per cent. of cases—a very disappointing finding since this result is very similar to that obtained with many less expensive forms of acetonaemia therapy. Limited work on pregnancy toxaemia seems to afford even less hope of success with this type of treatment.

Dr. Kerr will be summarising the work which has been carried out at Stormont on immunity and sensitivity phenomena in cattle, a form of investigation which seems to me to be more profitable in the present state of our knowledge than any designed to evolve direct information on methods of therapy.

Nevertheless, Shaw's postulation that acetonaemia of dairy cows is due to adrenal insufficiency involving the adrenal cortex and the anterior lobe of the pituitary is attractive. It seems only reasonable to accept the thesis that the stresses of high production must place a considerable strain on the " pituitary-adrenal axis " and that upset of this hormone mechanism must play a considerable part in the physiological imbalance which produces conditions of this type. In fact, it is not unduly speculative to suggest that this mechanism (which affects protein, fat and carbohydrate metabolism, the maintenance of certain intra- and extra-cellular electrolytes and water at physiological levels, and the functioning of lymphoid and connective tissue) must be involved in many of the so-called metabolic diseases of our domestic animals, and may even play a part in predisposition to some infectious conditions.

Much fundamental information must be obtained before the significance and importance of these hormones in animal health problems can be assessed but it seems likely that the knowledge which must accrue from world-wide research will advance and improve our ideas about the nature and treatment of disease. The therapeutic potentialities of the new substances which will become available must remain for the future to decide.

Summary

Recent advances in knowledge relating to the function of adreno-cortical hormones is discussed. The rôle of the medulla and cortex in maintaining the physiological well-being of the animal organism is indicated and a brief summary given of the known actions of the different types of steroid hormones elaborated by the gland.

Results of therapeutic trials of ACTH and cortisone in pregnancy toxaemia and acetonaemia are recorded as disappointing—the data available suggesting that adequate clinical responses are obtained in only 50 per cent. of cases, a degree of success which can be obtained with many other less expensive forms of therapy.

Brief mention is made of the fact that adequate experimental procedures for the investigation of corticoid function in ruminants are not particularly satisfactory and caution is suggested in the interpretation of data from ruminant material based on methods evolved for use with human urine and tissues.

The general thesis of the paper is that, in the present state of knowledge, the major contribution of recent findings in adreno-cortical physiology is as a stimulus to new exploration in the search for vital information about the nature of disease, and that assessment of the therapeutic efficiency of the potent hormones recently discovered requires much more investigation before their potentialities can be adequately appraised.

THE OPENER'S SPEECH

The Chairman said that they were very fortunate to have Dr. Kerr to open the discussion. Dr. Kerr needed no introduction. He was well known in many spheres, and attention might be drawn particularly to his work on cutaneous sensitivity.

Dr. W. R. Kerr (Belfast) said: I wish to express my sincere thanks to the Provisional Committee for asking me to open the discussion on Mr. McGirr's paper. It is a personal privilege for me to do so because Mr. McGirr was a member of the Stormont team for three years before returning to Weybridge and during that time of work together we in Stormont recognised and appreciated his ability both as a veterinary surgeon and as a biochemist and in addition his wide knowledge of the literature. This has stood him in good stead in compiling this paper. To be candid, when I first saw the title of the proposed paper I wondered just how would he tackle the subject

as the literature that has now accumulated is simply colossal, sparse in fact, and rich in speculation and complexities, with contributions by all branches of biological science. Before I make my few comments I feel I know nothing about this subject. My apologies. Unfortunately, the veterinary contribution is to say the least of it somewhat sketchy. However, I give him full marks because he has produced a gem of a summary, philosophical perhaps, but nevertheless he has omitted nothing that is relevant to the subject.

Due to the increased production and lowered costs of adrenal cortical hormones the gateway to the pharmacological use of these by the veterinary profession is being opened up and it is now time that sensible stock of its application should be made so that we can determine its rightful place, as a research tool, its therapeutic uses, or its application in the field of preventive medicine. I would imagine that one of the first difficulties that we have to face is that we are trying to apply the somewhat confusing results obtained in the medical field to the solution of our problems. Obviously the animal concerned in our case is the ruminant, which with its peculiar digestive system and its complex metabolic disturbances cannot be treated as a parallel with the non-rumen animals; new conceptions, therefore, must be built up.

I like Mr. McGirr's reference to delirium followed by execration and succeeded by a true evaluation. It is only too true, we would like to side-track the execration to evaluation and to do so we must avoid hit and miss methods without an experimental background.

The reading of the paper has given me great pleasure and I agree with almost all Mr. McGirr has to say, but I am assured on good authority that I must raise some issues; these I am afraid are small, nevertheless, I will welcome his comments.

Mr. McGirr is not too optimistic about the success to be expected with the use of ACTH in the topical conditions that concern the practitioner, namely acetonaemia and pregnancy toxaemia. The early results are a mixed bag, some good and some not so good. I would like, if possible, to discuss some of the variable factors which I think influence these results and my comments may also stimulate others to express their views, observations or experiences.

It is not always fully appreciated that acetonaemia is a metabolic disorder and not a disease entity, which may be precipitated by one or more of a variety of non-specific causes, circumstances including stress, all of which may be outside the normal range of physiological adjustment by the animal concerned. The mechanism of all this is obscure and complex and further confusion is caused by the fact that the condition cannot be reproduced experimentally. Orthodox treatment as applied is symptomatic. Perhaps only a pipe dream but it is a sincere hope that further knowledge of adrenal cortical activity in the bovine may eventually give us the answer to the aetiology of these metabolic disturbances. Shaw's theory of the mechanism of ketosis as adrenal insufficiency is attractive and one to my liking as a potential answer to the ketosis problem.

Some though may be given to the dosage—a definite dosage has never been confirmed in the bovine, nor as to what takes place when corticoids are injected. Due to the cost the dosage is kept at a minimum perhaps to fit the farmer's purse, but in my experience the dosage is often too small. Again, I feel that theory demands multiple injections at spaced intervals instead of a single injection. I fully appreciate that many workers have obtained good results with one injection and I have seen these myself; nevertheless, I do not think it accords with theory. I do not know of any case in human practice when one injection is used to obtain results. Shaw, of Maryland, in a personal communication says that he is getting better results with two injections with a 24 hour interval instead of one.

Injections of ACTH

What happens when ACTH is injected in an attempt to correct an imbalance in the affected animal is in question; some believe that it is purely pharmacological and direct in its action. I much prefer, however, to associate myself with the assumption that the increased amount of cortical hormone does not in itself initiate the various adjustments. It makes it possible for the various regulation mechanisms to expend the necessary additional energy to reach a normal condition. Some time must elapse before that is achieved. Our experience in this has been in the investigation of the blood picture of bovines following cortisone and ACTH injections. The effects are almost immediate; certainly within two to four hours the blood picture has changed, a rise in the neutrophils and a lymphopaenia taking place, with a return to normal within 12 hours, also an immediate effect in ketosis is a temporary rise in blood sugar, a slow fall in the ketones and lastly the rise of the milk yield, suggesting a return to balance. This end stage is, however, not an immediate result of the increased hormones, as several days may elapse before the final stage of recovery takes place. This would again suggest the restoration of balance is not entirely due to the direct action of ACTH.

Another variable may be the time factor, the duration of the state of ketosis before treatment is commenced.

Self-Limiting

So far I have been discussing difficulties in interpreting results. I would like now to look at the credit side. In Northern Ireland this year 12 practitioners have been using ACTH to a limited extent in ketosis and I am putting forward their experience of some 200 cases, without details, however, for it can only be an observation when we take into account small dosages, single injections and no tests carried out other than a Rotheras test for acetone bodies. They claim that 80 per cent. recovered to one injection and that the results were superior to the orthodox treatments. Some curious and interesting observations have been put forward, for example: "In herds where ketosis is prevalent the animals did not respond so well as the sporadic cases." The variation in results in ketosis in different areas is more probably the fact that the variation is in the different types of ketosis.

In pregnancy toxaemia their results were not good. What success some had they attributed to treatment of early cases. Another observation: "Cases that developed suddenly and carried their heads high responded to ACTH." Perhaps some of the other speakers will have some information to give on the treatment of early cases.

With regard to the application of adrenal cortical hormones to animal disease it is important to realise that the beneficial effects are purely temporary and with cessation of treatment the symptoms reappear, except in those conditions where an imbalance has existed and has been restored. Rheumatoid arthritis is a good example of the temporary alleviation. In such diseases as Addison's it is a question of replacement therapy and as such the treatment is dramatic, but must be continued indefinitely. This type of therapy would not interest us. The use of cortisone has also been shown to create a sense of well-being which could, however, mask some basic bacterial condition and lead to undesirable consequences. I believe, however, that it may have some application in shock therapy.

One of its more important and real uses it that it decreases sensitivity from bacterial and non-specific sources. In acute allergy in the human, more particularly in status asthmaticus the effects are dramatic, giving the patient a true relief, the physician in the meantime hoping that the patient will readjust his or her sensitivity balance to a more comfortable level. I would suggest in our field the allergic group of conditions as a profitable avenue of exploration with cortical hormone therapy.

Work at Stormont

Mr. McGirr made some reference to our work at Stormont and at the Lister on desensitisation brought about by the use of ACTH and cortisone. In 1946 we were concerned with the loss or reduction of tuberculin and trichomonad sensitivity which took place at the time of calving, as elicited by skin tests. We were aware at that time that the adrenal cortical hormones produced as one of its reactions a temporary but absolute lymphopaenia. Our examination of the blood of calved and desensitised animals showed that a rise of neutrophils and a lymphopaenia

took place some five to nine hours after parturition. That led us to believe that adrenal cortical hormones were implicated and experiments with cortisone showed that a similar blood picture and state of desensitisation was elicited some five to nine hours following injection.

We considered that the adrenal cortical hormone was one of the hormones at work in the last stages of parturition and that it was also associated with the desensitisation of the skin. This desensitisation is a non-specific one and would account for the useful application of corticoids to allergic conditions. It was the alleviation of the symptoms of rheumatoid arthritis at the time of parturition in female patients that led up to the primary use of cortisone for this purpose.

The adrenal corticals in treatment of human cases over an extended course may give rise to undesirable side effects which, however, disappear with cessation of treatment. It is doubtful if these side effects will be of any importance in our field, as cost at the moment will preclude its extended use in any one individual. Because of side effects and possibility of a cheaper production, search was made for substances not hormonal but possessing a cortical-like activity. There has been little in recent literature to suggest any success in this direction and I would like to know if Mr. McGirr has anything to add. We did find a substance called Sphingomyelin, an extract of bovine brain that we used along with ACTH and cortisone and which also produced a lymphopaenia and skin desensitisation. The M.R.C. later working on this substance produced a pure fraction called sphingosine which had all the activity of the original. I believe, however, that so far toxicity has been the stumbling block to the useful application of these substances.

One last point that I would like to raise for Mr. McGirr's comments. In the human and mouse a well marked eosinopaenia twice as deep as the lymphopaenia is found following injection of adrenal cortical hormones and is regarded of such importance that Thom's test is used as an index of cortical activity. In the bovine we found little movement of the eosinophils following injection of cortisone. In many hundreds of differential counts of bovines over a long period we found that the individual animal varied little in its eosinophil count but that there was a great variation from animal to animal. We have no explanation why some animals should have a high count and others, particularly calves, should have a low one.

The lack of eosinopaenia as we found it may only be another difference between the ruminant and the non-ruminant.

Finally I would make a plea: adrenal cortical hormone when it has been properly evaluated must take its place in our field of endeavour. To attain this a reasoned application backed by sound experimental evidence is necessary and I personally believe to do this a small independent committee should be created to give some guidance and control in the progress of this work and so avoid "execration."

Again my warmest congratulations and sincere thanks to Mr. McGirr.

THE GENERAL DISCUSSION

Mr. T. Barton Mann (Weyhill) said he was interested in this subject not so much from the point of view of ruminants as from that of pigs. He congratulated Mr. McGirr on his excellent paper because it saved one looking up a great deal of literature and it covered the field to a very great extent. It was obvious, however, that they knew very little about this subject and that their cures were just about equal to natural cures.

Mr. Barton Mann said he had been working on baby pig disease for quite a number of years, and whichever way he turned his treatment he had the feeling—though he could not categorically supply any scientific evidence—that in that disease there was some disfunction of the adrenal gland.

He had given baby pigs 90 to 100 milligrammes of riboflavin and within 24 hours they had recovered. With glucose the same sort of pigs would not be up on their feet within 48 hours. If the pig was got up with riboflavin there was no bone trouble, but with glucose there was often a sequel of bone troubles. There was no question that in baby pig disease there was a severe upset of the carbohydrate metabolism. He did not agree that there was always a low blood sugar, he had had occasional cases with normal blood sugar. As riboflavin was very efficient, would Mr. McGirr say if he had any knowledge of the reaction of the adrenal gland to shock doses of riboflavin?

Mr. J. B. White (Salisbury) said that as an ordinary G.P. he felt he would be asking for trouble if he entered the field of the biochemist, and he was not proposing to do so, but on the question of acetonaemia he was disappointed with the results of ACTH. In most cases it gave a temporary uplift and the animal improved in general appearance, the ketosis was diminished and the appetite increased for a short time. But this effect rapidly fell away and the animal relapsed into its earlier condition. Generally he had relied on three doses at 48-hour intervals.

This position brought them to Mr. McGirr's statement that he thought self-cure would probably give results nearly as good. Mr. White agreed with that to an extent because it seemed that all their treatments at the moment only gave the animal a period of adjustment in which she could re-establish a normal metabolic state. To his mind the most certain and most effective of all treatments was a complete cessation of milking. Could Mr. McGirr say in what way that had repercussions on the pituitary adrenal functions to bring about a cure? As far as self-cure was concerned, did Mr. McGirr attribute that to the fact that the animal ceased lactating during that time or to the fact that she ceased taking in food and gave the digestive system a chance of resting?

The Chairman said he regretted that the period for discussion was short and he would Mr. McGirr to reply to the points that the contributors had raised.

THE REPLY

Mr. McGirr, in reply, said that he would work backwards and deal with Mr. White's points first. Mr. White had been very good in supplying Weybridge with quite a lot of material in relation to this problem. As regards the way in which a cessation of milking affected the problem of acetonaemia, frankly Mr. McGirr did not know the answer. Presumably an animal's energy losses were considerably reduced by the cessation and the pituitary adrenal mechanism which was concerned with metabolism got a chance to deal with the normal metabolism of the animal without having to deal with the extra strain caused by milking. The fact was that the animal was not losing energy through milking, and also was perhaps not having to deal with large quantities of food but was relying merely on its own body protein to provide the requisite carbohydrate to keep it going.

As regards the reference to baby pig disease, Mr. McGirr was afraid he was out of his depths. He was not clear as to what was meant by baby pig disease, particularly when it involved high blood sugars. He was under the impression, though it might be wrong, that unless an animal had low blood sugar it could not very well have baby pig disease. The precise effect of riboflavin on the adrenal mechanism was not known to him. There was some literature about riboflavin and the adrenal function, but he could not remember what it was. Certainly it was a question he had not come across himself to any extent.

He thanked Dr. Kerr for his opening remarks and for his flattering and in some instances untrue compliments. He could not agree more with Dr. Kerr's remarks on acetonaemia in cattle. It arose from a wide variety of causes, from digestive causes, stress of one sort or another and from an actual disfunction of the pituitary mechanism. One must remember that all the hormones produced in an animal were inter-related and an upset in any one could lead to a very peculiar effect because all the others were out of balance and needed readjustment.

It was interesting to note that the thyroid seemed to be quite considerably concerned with adrenal function and that there was quite a large degree of balance maintained between thyroid output and adrenal cortical output.

The question of dosage was a tricky one. Cost played a big part. ACTH had been used in the range of from 200 to 600 units in single doses repeated at 24 and 48 hour intervals over a matter of three or four doses. Even when the largest doses were given the results were not particularly good in acetonaemia, and, of course, that therapy was very costly indeed. Even if fairly large doses of ACTH were introduced into an animal whose blood sugar was fairly normal it was extremely difficult to push it up higher. If the blood sugar was down to 25 mg. per cent. quite a small dose of ACTH would push it up considerably for a relatively short time, but in a normal bovine ACTH did not push the blood sugar much above the normal level.

A considerable amount of work on the effects of adrenal hormones in normal cattle and sheep had been carried out at Weybridge. Nothing seemed to happen to a normal sheep, at any rate, and to a certain extent to a normal cow. In the normal state ruminants appeared to keep blood minerals and urinary excretion in balance and to deal adequately with what must be quite considerable quantities of hormones. That raised many difficulties from the laboratory angle.

It was interesting to hear the Northern Ireland results in dealing with ketosis. 80 per cent. recoveries was certainly a higher figure than that found in most parts of England, and it was rather difficult to see why that should be. Dr. Kerr did, however, mention that results were better in sporadic cases than in cases where a herd was involved. One wondered what proportion of these cases would have recovered spontaneously.

Adrenal Hormones and Parturition

As far as adrenal hormones and parturition were concerned the problem was an interesting one. The work done in Ireland a few years ago did implicate the adrenal cortex in some changes in blood and in the skin desensitisation which occurred at parturition. It seemed likely that some of the disfunctions to which parturient cattle were prone might be bound up with adrenal function, but Mr. McGirr said that at the moment he was not in a position to make any comment.

He had made a check up of blood changes following the use of these preparations, and certainly agreed that the eosinopaenia which was recorded in man and rabbits and other laboratory animals did not occur in the bovine. The bovine's white blood cell picture was very different indeed from that in man and laboratory animals, so that another difference was perhaps not altogether surprising.

Mr. McGirr thought he ought to say one word on the desensitisation question. There were possibilities for some of the adrenal hormones as desensitising agents in odd conditions in the bovine and possibly other animals.

Mr. McGirr concluded by thanking his audience for their patient listening. He trusted that his summary had helped a little in giving them an idea of the present position in relation to the adrenal function.

The Chairman said he wanted to congratulate Mr. McGirr on coining a new phrase, the "pituitary-adrenal axis," which might in the future become known as "McGirr's axis." The moral of the meeting was that they should regard the whole of the endocrine system as a single unit. They thanked Mr. McGirr gratefully for his paper, and Dr. Kerr for opening the discussion.

MINISTRY OF AGRICULTURE VETERINARY FIELD STAFF

Mr. D. A. J. Weedon, M.R.C.V.S., Veterinary Officer, has been transferred from Hereford to Beaconsfield, Buckinghamshire, and the following have been appointed to the permanent staff as Veterinary Officers:—

Mr. A. Ferguson, M.R.C.V.S., stationed at Hereford; Mr. N. S. Needham, M.R.C.V.S., stationed at Welshpool; Mr. G. P. Russell, M.R.C.V.S., stationed at Truro.

ACCESSIONS TO THE R.C.V.S. LIBRARY

The following publications have been received in the library during the last week.

COMMONWEALTH AGRICULTURAL BUREAUX. Twenty-fifth annual report of the executive council, 1953-1954. 1954.

DENMARK. Royal Veterinary and Agricultural College. Yearbook, 1954.

DUJARRIC DE LA RIVIERE, R. *and* EYQUEM, A. Les groupes sanguins chez les animaux, Paris, Editions médicales flammarion [1953].

KENYA, Colony and Protectorate, Department of Veterinary Services, annual report, 1953.

LOS ANGELES, County, Livestock Department, annual report, 1953-1954.

ONTARIO VETERINARY COLLEGE. Report for the year 1953.

THE R.C.V.S. AT CHRISTMAS

The Office and Library of the Royal College of Veterinary Surgeons will be closed from 5 p.m. on Thursday, December 23rd, until 10 a.m. on Tuesday, December 28th, 1954.

ERRATUM

In the obituary notice of Mr. Balbur Singh, printed in our issue of December 4th, the date of his graduation was incorrectly given as July 14th, 1954. It should have read July 14th, 1933.

Fungoid Infections of Animals in Britain (concluded)

of an organism one was quite unable to control or even identify correctly, and that aspect was a major factor.

There was another factor which had a world-wide effect. About 1930 the United States Department of Health took the unprecedented step of appointing a mycologist, a botanist, to the Department. That was followed by several similar appointments, and there were in the United States at least 12 professional medical or veterinary mycologists who were trained as mycologists. That had the effect that Mr. Watkins had had in the south-west. It might be said that the south-west was a very mouldy area, and if the survey samples were plotted there was seen to be a curious concentration in the south-west and in certain other provinces.

The appointment of medical mycologists in the United States resulted in many records of mycoses in man and animals in the United States, and just as in this country mycoses were very sensitive to administrative boundaries, so in North America were they sensitive to political boundaries. There were few records of mycoses from Canada and Mexico where there were few medical mycologists; it seemed that the appointment of mycologists led to all the trouble!

The Chairman said he was sure they would want him to thank Dr. Ainsworth in their name for opening and answering the discussion on mycology to-day. Despite Dr. Ainsworth's modest appraisal of his own work there could be no doubt that little could be done in opening up a new field without the right type of worker. Dr. Ainsworth was undoubtedly of this type and had done a very great deal to stimulate interest.

The vote of thanks was carried by applause and the session then concluded.

Professor R. E. Glover, M.A., B.Sc., F.R.C.V.S.

The appointment of Professor Glover to be the new Principal and Dean of the Royal Veterinary College in succession to the late Professor J. B. Buxton has given pleasure to the whole profession. Professor Glover is not only known and esteemed as a research worker and teacher, but his tour of the Divisions of the B.V.A., as described in the last Supplement to THE RECORD, has made him personally well known to many members of this Association who are in general practice.

At a time when veterinary education is advancing in all fields, and its importance is greater not only within the profession but to the community as a whole than ever before, it is a source of satisfaction that the Governors of the College have selected this ripe scholar and accomplished man of affairs to guide the destinies of one of the most important veterinary schools in the world.

Ronald Everett Glover was born on Christmas Day, 1897. He was educated at Emmanuel School, Wandsworth, and entered the Royal Veterinary College as a student in 1915. His education was interrupted almost immediately by the First World War and he joined H.M. Forces in 1916 and served in France until his demobilisation in 1919. For a period he was a prisoner of war in German hands.

He resumed his studies after demobilisation and was awarded the M.R.C.V.S. Diploma in July, 1921, taking the B.Sc. (Vet. Sci.) of London University in the following December.

He became a research scholar of the Ministry of Agriculture from the years 1921-23 working first at the Research Institute R.V.C. under Sir John M'Fadyean and then at the Laboratoire National de Recherches, Alfort, under Professor H. Vallee. He worked in the Pasteur Institute for one year.

In 1923 the Medical Research Council appointed Mr. Glover (as he then was) to the National Institute for Medical Research to assist in investigations on the double intradermal tuberculin test. He remained with the Council until 1924, when he began a long period of work which lasted until 1937, with the then newly created Institute of Animal Pathology, Cambridge. By coincidence he was associated there with Professor J. B. Buxton, whom he now succeeds. While at the Institute his main investigations were into virus diseases, tuberculin tests and vaccination of cattle with B.C.G. During this period of his career he was awarded the Fellowship of the Royal College of Veterinary Surgeons, receiving it in 1933.

He left Cambridge in 1937 and at the invitation of the Medical Research Council succeeded Major G. W. Dunkin as Superintendent of the Farm Laboratories attached to the National Institute for Medical Research. In addition to supervising the small-animal breeding unit he undertook researches into human and swine influenza. He continued to retain his interest in other forms of respiratory infection including tuberculosis. He also devised improved methods for the preparation and standardisation of johnin. That part of his work which required the supervising of the small-animal breeding unit led to his next appointment when he became, in 1947, the first Director of the Laboratory Animals Bureau. The foundations of that work, which he laid so firmly, have made for the Bureau a unique place in research work. Scientists in many fields now depend upon the Bureau for the supply of healthy animals of the right type for laboratory use. While engaged in creating this new unit Professor Glover played a leading part in the formation of the Animal Technicians' Association.

In 1949 he received the reward of his years of study and teaching by being appointed to the newly created Chair of Veterinary Pathology in the University of Liverpool. The loss sustained by his students there will be the gain of those who are studying in London. His connection with the B.V.A. was mentioned in our brief note last week and it may be added that he was awarded the Dalrymple Champneys Prize in 1952.

This brief sketch of his career will sufficiently attest the breadth of Professor Glover's interests and the mark he has made upon veterinary science in his time. The following short list of some of the offices he has held further illustrates his versatility. He is a founder member and has been President of the Veterinary Research Club. He has been both President and Hon. Secretary of the Section of Comparative Medicine, Royal Society of Medicine. He serves with the Agricultural Research Council as a member of the Animals Committee and Chairman of the Scrapie Committee and the Tuberculosis Committee. Additionally he is a member of the governing body of the Virus Research Station at Pirbright. Professor Glover's past Chairmanship of the Editorial Committee of this journal was mentioned previously and he is now a member of the editorial board of the *Journal of Comparative Pathology and Therapeutics*.

Professor Glover is assured of a warm welcome by his colleagues in London, who will look to him with confidence to uphold and enhance the status of the Royal Veterinary College, not only within the University of London, but among veterinary schools the world over.

News and Comment

CONFORMATION OF THE BOVINE JAW

The Secretary of State has decided that the following definition of the standard to be applied in the matter of overshot jaws when considering applications for bull licences, will come into force in Scotland forthwith:—

> "A bull shall be considered abnormal if the four central incisors protrude to the extent of preventing contact between the upper part of these teeth and the dental pad."

The adoption of this definition will result in uniformity of practice throughout Great Britain and will avoid any risk of a bull licensed in one country being refused a licence on grounds of this particular defect on transfer across the border.

COMING EVENTS

Dec. 23rd.—General Meeting of the Southern Counties Division, B.V.A., at the Grand Hotel, Bournemouth, 6 p.m.

Dec. 30th.—Annual Dance of the Ladies' Guild, Dumfries and Galloway Branch of the V.V.B.F., in the Cairndale Hotel, Dumfries.

Jan. 4th.—14th Ordinary General Meeting of the A.V.T. and R.W's. at the University of Liverpool Veterinary Field Station, Leahurst, Windle Hill, Neston, Wirral, Cheshire, 10.30 a.m.

Jan. 12th.—Meeting of the R.A.V.C. Division, B.V.A., at Boots Pure Drug Co. Veterinary Science Division, The Priory, Thurgarton, Notts, 12 noon.

Jan. 27th.—Annual Dinner-Dance of the North of Scotland Division, B.V.A. (in aid of the Victoria Veterinary Benevolent Fund), in the Northern Hotel, Aberdeen, 7.30 p.m.

B.V.A. QUARTERLY MEETINGS

The arrangements for January are:—

Wednesday, January 19th.

10.15 a.m. Organising Committee.
2.0 p.m. Home Appointments Committee.
4.0 p.m. Parliamentary & Public Relations Committee.

At 7, Mansfield Street, W.1.

Thursday, January 20th.

10.30 a.m. Veterinary State Medicine Committee.
2.0 p.m. General Purposes & Finance Committee.

At 7, Mansfield Street, W.1.

Friday, January 21st.

10.30 a.m. Council meeting.
At the Connaught Rooms, Gt. Queen Street.

PERSONAL

Births

GRAVES.—On December 7th, 1954, to Margaret Joan (*née* Morle), wife of John A. Graves, B.SC., M.R.C.V.S., D.V.S.M., of Wiveliscombe, Somerset, a daughter—Sally Frances.

OWEN.—On November 30th, 1954, at Bryn Beryl, Pwllheli, to Lona (*née* Lewis), wife of Desmond C. Owen, M.C., M.R.C.V.S., a son.

PARKINSON.—On November 29th, 1954, at Hereford, to Susan (*née* Mills), B.V.SC., M.R.C.V.S., and William Gerald Parkinson, B.V.SC., M.R.C.V.S., a son—Henry Samuel.

ADDRESSES OF DISEASE-INFECTED PREMISES

The list given below indicates, first, the county in which are situated the premises on which disease has been confirmed, followed by the postal address and date of outbreak.

Anthrax:

Cumberland. Moorend, Dockray, Matterdale, Penrith (Dec. 6); Dockray Hall, Wigton (Dec. 9).

Devon. Morganhayes Farm, Southleigh, Clayton (Dec. 6).

Durham. North Park Lodge Farm, Whitworth, Spennymoor (Dec. 6).

Lancs. Waterhouse Farm, Wardle, Rochdale (Dec. 8).

Leics. Coplow Farm, Billesdon, Leicester (Dec. 9).

Yorks. Hill Top Farm, Birkenshaw, Bradford (Dec. 6); Leaventhorpe Farm, Fairweather Green, Bradford (Dec. 7); South Farm, Scoreby, Gate Helmsley (Dec. 8).

Fowl Pest:

Essex. Woodhall, Arkesden, Saffron Walden (Dec. 8); New Hall, Little Wigborough, Colchester (Dec. 9).

Gloucs. Drew's Court, Churchdown, Gloucester (Dec. 6).

Norfolk. Pound Farm, North Tuddenham, E. Dereham (Dec. 6); The Ramblers, Norwich Road, Poringland, Norwich; Church Plain, Mattishall; Ivy Farm, Badley Moor; Church Farm, Welborne, Dereham (Dec. 7); Malt and Hops Inn, The Heath, Hevingham, Norwich; Clint Green Farm, Yaxham, Dereham (Dec. 9).

Sussex. Wood View, Back Lane, Cross-in-Hand, Heathfield (Dec. 7).

Swine Fever:

Bucks. Plot 2 Piggeries, Finch Lane, Amersham (Dec. 7); The Allotments, Woolstone Lane, Great Linford, Newport Pagnell (Dec. 8).

Cardigan. Rhosfawr, Penrhiw, Llanrhystyd (Dec. 13).

Ches. Holme Farm, Childer Thornton, Little Sutton, Wirral; Mount View, Malpas (Dec. 9); Hawthorn Farm, Tarvin Road, Frodsham (Dec. 10); Hillfield Farm, Mobberley, Knutsford; Springfield Farm, Oakmere, Northwich (Dec. 13).

Essex. Chequers Lane, Dagenham Dock, Dagenham (Dec. 8).

Flints. New Hall Farm, Kinnerton, Chester; Wynne House, Calcott, Holywell (Dec. 13).

Glamorgan. Ely River Allotments, Leckwith, Cardiff (Dec. 10).

Herts. Hedge End Farm, Perry Green, Much Hadham (Dec. 11).

Lancs. 10, Clifton House Road, Clifton, Swinton, Manchester (Dec. 9); Piggeries at Henshalls Potato Yard, Glasshouse Street, Manchester, 4; Damside Farm, Pilling; Gracefield Farm, Kirkland, Preston (Dec. 10); Vauxhall Farm, Clayton Bridge, Manchester; Quarry Cottage, Quarry Road, Liverpool, 13 (Dec. 13).

Lincs. Station Road, Surfleet, Spalding (Dec. 10).

Montgomery. Tan-y-Coed, Meifod (Dec. 9); Plas-Bach Issa, Llansantffraid (Dec. 10).

Salop. 14, Tilstock, Whitchurch (Dec. 9).

Staffs. Ankerton Farm, Eccleshall (Dec. 7); Beacon Hill Farm, Penkridge, Stafford (Dec. 10).

Suffolk. Chapel Street Farm, Stoke by Clare, Sudbury (Dec. 7); Downs Allotments, Haverhill (Dec. 10).

Worcs. Highfield Farm, Headley Heath, Kings Norton, Birmingham, 30 (Dec. 8); Bungalow Piggeries, Nooks Green; Cider Mill Farm, Bradley Green, Feckenham, Redditch (Dec. 13).

CORRESPONDENCE

The views expressed in letters addressed to the Editor represent the personal opinions of the writer only and their publication does not imply endorsement by the B.V.A.

THE NUTRITION CONFERENCE

Sir,—The Technical Development Committee must be congratulated on arranging the meeting concerning the Feeding of Farm Animals for Health and Production, for closer liaison between the profession and other bodies represented must ensue.

May I suggest that more would be achieved at such gatherings if the papers were circulated beforehand and taken as read at the meeting, so that the time available could be devoted to discussion?

After each of the papers (which were read verbatim) the chairman had to request the meeting to be brief with its questions, and there can be no doubt that many more of the assembly would have participated if (1) there had not been an acute lack of time; (2) one had been able to read and think about the papers beforehand.

It is impossible for us of the rank and file to absorb, discuss or contribute at a moment's notice to a highly technical paper which has taken the reader in all probability several weeks to prepare. Surely the purpose of a conference is to obtain and disseminate the views not only of the principal speakers, but of the whole assembly?

Yours faithfully,

PETER J. DALTON,

Old Sarum House,
Stratford Road,
Salisbury.

November 22nd, 1954.

CANINE DISTEMPER

Sir,—The papers published in THE VETERINARY RECORD of October 9th and 16th, under the title "A Survey of Canine Distemper," were of absorbing interest. Nevertheless they leave me unconvinced that the syndrome we were all taught to call distemper and that which has, of recent years, been dubbed "hard pad disease" are different manifestations of the same viral infection.

If for the sake of argument, we assume that these two diseases are quite separate and distinct and if, for comparison, we list the symptoms as seen by the observant clinician, what do we find?

It will be seen from the table (overleaf) that the two clinical pictures are indeed different. It would appear that true distemper is primarily a respiratory disease, and involvement of the central nervous system is only secondary. Hard pad, on the other hand, appears to be an infection of the central nervous system from the outset.

Most members with much canine practice will agree that the distemper syndrome, as described by Laidlaw & Dunkin, is not nearly so common to-day as it has been in the past but the hard pad syndrome is with us all the time.

Could it not be that, as a result of the widespread use of the proven anti-distemper prophylactics throughout the country over a period of many years, the distemper virus has suffered from the consequent loss of suitable environment in which to flourish and that its virulence has diminished as a result?

Woodrow (1949) has described an outbreak of hard pad disease in a batch of Huskies which he treated successfully with virulent distemper virus. I tried this line of treatment on three separate occasions, one of which was spectacularly successful. If the causal virus of the two syndromes was the same surely even an isolated recovery under such treatment should be quite impossible.

Is it possible that "in nature" these two viruses are antagonistic and that by our extensive anti-distemper inoculation campaign we have so disturbed the balance of nature that the hard pad virus, finding the power of its enemy reduced, has been able to thrive unhindered to its present serious stage?

Yours faithfully,

A. NOEL ORMROD,

Woodchurch,
Wirral.

Reference

WOODROW, C. E. (1949). Vet. Rec. **61**. 821.

	Distemper	Hard Pad Disease
Age group	Seen mainly in puppies and young adults.	Seen only rarely in young puppies but common from six months to four years and sometimes even later.
After inoculation with Serum-Virus or Vaccine-Virus	Rarely, if ever. Many so-called breakdowns being wrongly diagnosed.	Seen as commonly in the inoculated as in the un-inoculated dog.
Onset of illness.	Usually quite rapid. The clinician rarely has to wait more than a day or two to confirm his diagnosis.	Insidious and slow. A week or more may elapse before a strong suspicion becomes a sorry certainty.
Temperature	The di-phasic stage described by Laidlaw and Dunkin is rarely seen in practice. The curve in a fatal case being either a gradual rise to 105 or more accompanied by a parallel deterioration of the patient, or it may rise by a series of "steps" each step being accompanied by an obvious change in condition of the dog.	An almost immediate rise to 103 remaining steady around this point quite frequently for several weeks. During this time there is seldom much change in the condition of the animal. Late in the course of the illness there may be a sudden rise to 105 or higher as a prelude to the exhibition of severe central nervous disturbance and death.
Nasal discharges.	Copious and filthy. Often seen hanging or running from the nostrils. Usually appears quite early.	Scanty and sticky, resulting in a semi dried up obstruction of the nostrils. Not usually seen until later.
Occular discharge. (Of little diagnostic value).	Similar in character to that from the nose but usually arising subsequent to nasal discharge. (Probably due to ascending infection via the lachrymal duct or from direct inoculation via the paws.)	Scanty and sticky. Quite frequently not seen at all.
Gastro-intestinal symptoms.	Emesis rare and of little importance. Diarrhoea common but seen usually in the middle or late stages. Appetite diminished from the start. Often disappears entirely as nasal discharge increases.	Emesis very rare. Diarrhoea is frequently the first indication to the owner that all is not well with the dog. Often improves after a few days treatment. Appetite very variable. Some dogs maintain a fair appetite until the late stages whilst others lose it quite early. There is frequently some improvement in the middle stage.
Respiratory symptoms.	"Distemper Cough" is often an important early sign. Examination of throat shows no visible change in tonsils or pharynx. Disease frequently terminates in pneumonia.	Cough is infrequent but quite often in the early stage the tonsils are seen to be reddened and protruding. Clinical pneumonia is uncommon.
Nervous symptoms.	Epileptiform convulsions, "chorea" and various forms of ataxia or paresis may be seen late in the illness. These are frequently the cause of euthanasia. Death from these complications is rare when the disease is allowed to run its course. Pneumonia being the usual actual cause of death.	Severe epileptiform convulsions are the invariable end in the fatal case. These are frequently heralded by a sudden rise in temperature and the exhibition of an imbecile appetite.
Hyperkeratosis of pads and/or nose.	Rarely, if ever, seen. (Not to be confused with the excoriation around the nose due to the nasal discharge.)	Seen in practically every case. Frequently develops only in the later half of the illness. The hardening of the pads follows a definite pattern or sequence. The pads first flatten and then harden from the periphery until the whole pad is thick, hard and flat.